The magazine for Sinclair users and TIMEX/Sinclair users

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September/October 1983
Volume 3, Number 5

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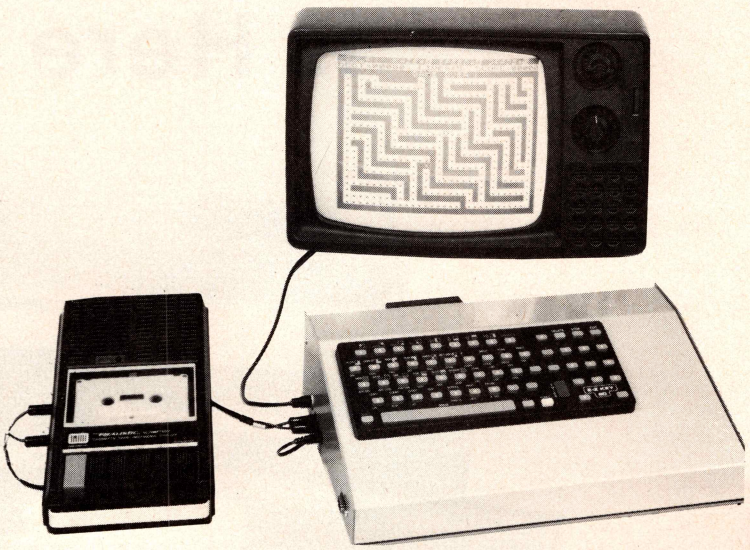

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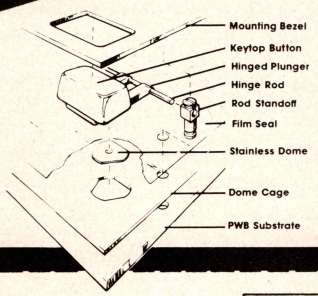

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SYNC

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Volume 3, Number 5

SYNC (USPS: 585-490; ISSN: 0279-5701) is published bi-monthly by Ahl Computing, Inc., a subsidiary of Ziff-Davis Publishing Company. David Ahl, President; Elizabeth B. Staples, Vice-President; Selwyn Taubman, Treasurer; Bertram A. Abrams, Secretary. 39 E. Hanover Ave., Morris Plains, NJ 07950. Second class postage paid at New York, NY 10001 and at additional mailing offices.

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Subscription rates: USA: One year (6 issues), $16; two years (12 issues), $30; three years (18 issues), $42. Canada: $3 per year additional. Other foreign: $5 per year additional.

For *SYNC* advertising information, contact Karen Musmeci, *SYNC* Advertising Sales Manager, Ziff-Davis Publishing Company, One Park Ave., New York, NY 10016 (phone: 212/725-4216).

All other correspondence should be addressed to: *SYNC*, 39 E. Hanover Ave., Morris Plains, NJ 07950. In U.K. to: *SYNC*, 10 Bishops Way, Sutton Coldfield, W. Midlands B74 4XU.

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letters

Payroll

Dear Editor:

I would again like to compliment both SYNC and Alan Pattison for an excellent program "Small Business Payroll" (*SYNC* 3:2). However, I found that I could not copy any of the screen displays on my printer because any keyboard input routes you to another section of the program.

Some of the menu items I wanted to copy are: 2, 4, 5, 6, 8. By adding the following lines I am now able to copy any screen display I want:

```
 442 IF M$="Z" THEN COPY
 443 IF M$="Z" THEN
  GOTO 440
 976 IF M$="" THEN
  GOTO 975 (was 978)
 977 IF M$="Z" THEN COPY
 978 IF M$="" THEN
  GOTO 975
1993 IF M$="Z" THEN COPY
1994 IF M$="Z" THEN
  GOTO 1990
3917 IF M$="Z" THEN COPY
3918 IF M$="Z" THEN
  GOTO 3910
4142 IF M$="Z" THEN COPY
4143 IF M$="Z" THEN
  GOTO 4140
```

To make room for these changes and to stabilize the program (I was getting a lot of Report Codes due to memory saturation), I reduced the number of employee records from 35 to 30.

I appreciate your publishing these valuable programs and look forward to similar programs in future issues.

Robert Keneely
125-10 Queens Blvd.
Kew Gardens, NY 11415

PCB Differences

Dear Editor:

Timex Sinclair users should be aware that Timex has used several different printed circuit board etch patterns in producing the ZX81 and the TS1000. As a result, the experiementer may be confused by differences in the patterns which the conductor strips make on the solder side of the board. Practically speaking, this means that readers attempting to follow Figure 7 in my article "Keyboard System Conversion" (*SYNC* 2:3, p. 30) may find that the etch pattern of their CPU board is different.

The key is to remember that, no matter what version of the PCB one has, the pin assignments on all ICs must be the same, all components have the same relative position, the signals of the keyboard connector must be in the same order, and the wiring of the keyboard conversion cable puts lines AB-A15 and KBO-KB4 in the same order.

Readers should note that this difference in etch patterns may apply to other products and modifications which require that a certain signal line be jumped or a particular trace be cut. Experimenters should refer to a ZX81 schematic for assistance in identifying different traces using a "variant" PCB etch pattern or one which does not resemble exactly an illustration in a hardware article.

Robert B. Trelease, Ph.D.
2313 5th St.
Santa Monica, CA 90405

Keyboard Bumps

Dear Editor:

After playing a few games that required fingers on several keys, I found that I could not consistently keep my fingers in place. After trying several ways of creating a bump I could feel on the keys. I settled on 5 minute epoxy. It sticks well to the keyboard surface and can be easily removed without damage by a fingernail. I used a toothpick to apply a small (very small) drop in the center of each key. After an hour, the epoxy was fully cured, and I have a tactile keyboard that cost next to nothing.

Ted Rodgers
1157 W. Peachtree St., N.W.
Atlanta, GA 30309

Stringing along

Dear Editor:

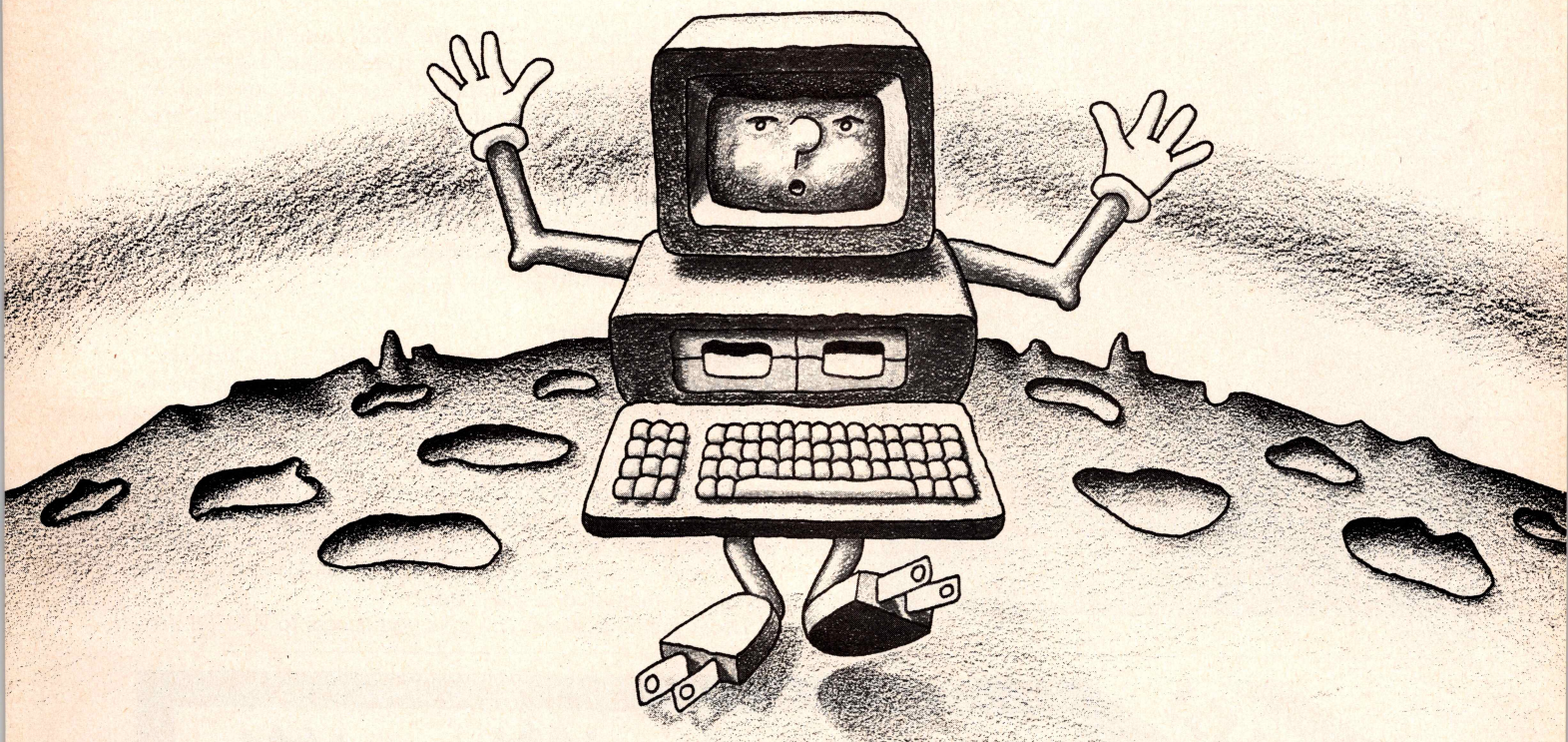
I enjoyed Paul Wentink's "Stringing along with the ZX81" (*SYNC 3:4).* However, it does have some limitations. It does not allow for freely formatted data. For instance, it allows for only numbers of the same length, e.g., 30, 40, 50, and not for 1.325,-.82, 100.367.

I am an economist, and in trying to use the data storage capabilities of the ZX81 to the maximum I devised a way to store numerical data in a flexible way. The lines below give a DATA-READ simulation which allows for variable number lengths and variable size arrays. The method is flexible since you can have the ZX81 recognize any data separator, e.g., a space, merely by changing the contents of the strings in lines 60, 70, and 80.

```
 10 LET A$="10,1.235,
 -.82,101.5,"
 20 DIM A(4)
 30 LET Q=0
 40 LET P=1
 50 FOR I=1 TO LEN A$
 60 IF A$(I)="," THEN
 LET Q=Q+1
 70 IF A$(I)="," THEN
 LET A(Q)=
 VAL A$(P TO I-1)
 80 IF A$(I)="," THEN
 LET P=I+1
 90 NEXT I
100 FOR I=1 TO 4
110 PRINT A(I)
120 NEXT
```

Barry Crozier
291 Windermere Rd., Apt. 252
London, Ont.
Canada N6G 2J9

"What more can I do?"



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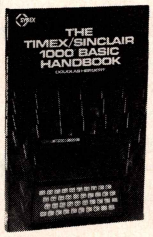

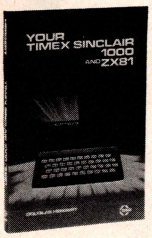

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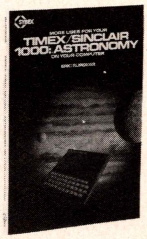

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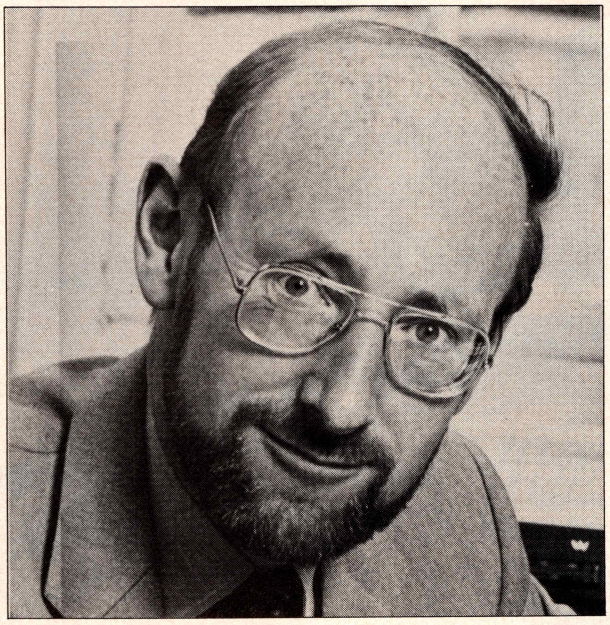
sync notes

Paul Grosjean



Sir Clive

Sir Clive

As we all know, the ZX80, the ZX81, and the Spectrum computers—the computers which have enabled hundreds of thousands to enter the computer age—were invented by Clive Sinclair in Great Britain. On June 11, 1983, he became Sir Clive when Birthday Honors were bestowed by Queen Elizabeth II. Sinclair, whose company Sinclair Research is a market leader in volume production of personal computers, said that the event came as a complete surprise. "More than ever I feel committed to achieving success both in and for Britain," said Sir Clive.

SYNC at the Library

Our theme section this issue is "SYNC at the Library." This is a Book Buyer's Guide. We have gathered together as many titles and brief descriptions of printed resources as we could find, but we know the list is not definitive. The book list for the ZX81 and TS1000 is a long one. Since Eric Deeson has given us an overview of books from the U.K., the Spectrum section includes those that are currently available from U.S. publishers. The general category could be much more comprehensive, but where could we stop? We have just suggested a few titles.

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CIRCLE 15 ON READER SERVICE CARD

cles in other publications through various readers guides and indexes. Indexing services and data banks covering only computer publications are now available.

We have not covered any works of fiction since at this time we have not heard of any in which the ZX/TS computer plays a role. As we would expect, computers do play a substantial role in science fiction stories, especially some of the more recent works. We find three main themes that seem the most popular.

First, the computer is a tool in the hands of the forces of Good. In such stories, it is strictly subordinate to the human users. It is "user friendly." E.E. "Doc" Smith fans will recall the "cubic mile" Brain in the Skylark series and The Brain in the final story in the Lensman series.

Second, the computer as a tool in the hands of Evil for the domination, repression, or social control of humanity. The conflict is between human beings, but victory for Good requires besting not only Evil, but also the computer. This theme is illustrated by E. Hoffman Price's *Operation Misfit* and Roger Zelazny's *My Name is Legion* (an allusion to the unclean spirits cast out in the biblical story in Mark 5).

But perhaps the most fascinating theme is the computer as Man's ultimate enemy. How does Man defeat the Computer when it has assumed virtually the power of divinity? We immediately think of the famous (or infamous) "Hal" of *2001* and his most recent rival "The Ultimate Computer" designed by Gus in *Superman III. The Funco File* by Burt Cole is based on The Machine which must deal the problem of deviation in its ordering of the world.

Such works are provocative and entertaining ways of exploring the issues that must be faced as the computer age develops. Many more issues need to be explored, however. What is your favorite computer related story? Drop a card to *SYNC* with the title, author, and a brief statement of the computer's role in the story. Be sure to include your name and address. Now, did anyone read the one about the night the ZX81 (with only a 2K RAM upgrade and a few additional chips mounted on an expansion board bought from a SYNC advertiser) took over a large midwestern city, and . . .

Next Issue

The theme section for our next issue will be "SYNC at the Concert," and will gather articles, programs, and products having to do with music and sound on the ZX/TS computers. We will also take a look at expansion keyboards.

Upcoming themes include another look at the home and business office (including word processing packages) and at work related computer uses.

In and Out of SYNC

The ZX80 was introduced as the first personal home computer under $200. The proliferation of computers in that price range inevitably invites comparisons with the ZX/TS computer. In this issue we are beginning a new department called "In and Out of Sync."

We are planning to have a two pronged thrust to this department. First, we will take a close look at one of the other computers in this lower price range. Then we will take some programming techniques on the ZX/TS computers and see how these are done on the machine being reviewed and at least one other computer, or we will take a technique from another computer and see how the same thing can be done on the ZX/TS computers. We will begin with a look at the Panasonic JR-200 and compare programming on the TS1000, the JR-200, and the Vic-20. ■

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just for fun

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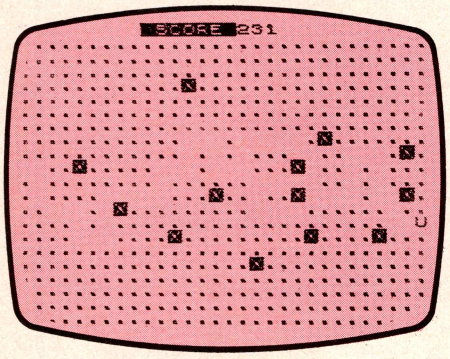
"Just for Fun" shares these programs with you. If you learn something, great. If you have some fun, great. If you have some programs that you want to share, send them to: Just for Fun, SYNC, 39 E. Hanover Ave., Morris Plains, NJ 07950.

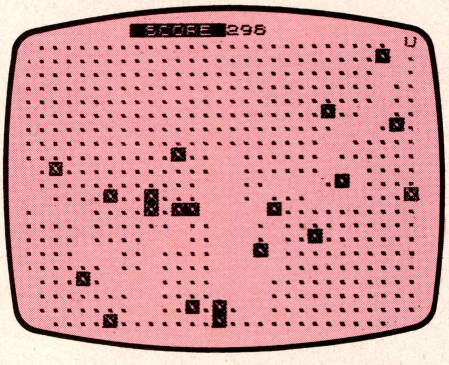
Survive

Robert J. Midura

8K ROM; 16K RAM

The object of "Survive" is to survive long enough to obtain score points before the computer zeroes in on your location and blasts you. You manuever on a 21 x 31 grid of periods using the arrow keys on 5, 6, 7, 8. Each time you land on a period, you get 2 points. Landing on a location that has been hit (marked with an inverse X) results in losing 1 point. Landing on a clear location (a space) does not affect your score.





As you move, the computer will blast locations according to your location and direction. You should not stay in one location or head in one direction for too long or you will be hit.

The game ends when you are hit or you move into screen column 31. Ending the game by moving into column 31 will net you a bonus of 100 points.

Type in the program as shown, put the computer in SLOW mode, and type GOTO 1000. To play again, type CONT and ENTER. You may adjust the difficulty by changing the values in line 60. Use large integers for easier games and smaller integers for harder games.

Graphics notes:

80: T,Y,T,Y, inverse X.

110: Inverse space, inverse SCORE, inverse space.

1030: Space, 31 periods.

Listing

```
  5 LET L=(INKEY$="6" AND X<21)
-(INKEY$="7" AND X>1)
  10 LET C=(INKEY$="8" AND Y<31)
-(INKEY$="5" AND Y>1)
  15 PRINT AT X,Y;" "
  20 LET X=X+L
  25 LET Y=Y+C
  30 PRINT AT X,Y;"U"
  35 IF Y>30 THEN GOTO 110
  40 LET S=S+M(X,Y)+2
  42 LET M(X,Y)=-2
  45 LET T=T-1
  50 IF NOT T THEN GOTO 80
  55 IF T>0 THEN GOTO 5
  60 LET T=INT (RND*3+3)
  65 LET H=X+T*L
  67 IF H>21 THEN LET H=21
  68 IF H<1 THEN LET H=1
  70 LET I=Y+T*C
  72 IF I<1 THEN LET I=1
  73 IF I>31 THEN LET I=31
  75 GOTO 5
  80 PRINT AT H,I;"▚";AT H,I;"▞"
;AT H,I;"▚";AT H,I;"▞";AT H,I;"▚
"
  100 LET M(X,Y)=-3
  105 IF H<>X OR I<>Y THEN GOTO 5
  110 PRINT AT 0,11;"SCORE";S+(
100 AND Y>30)
  115 STOP
1000 LET X=10
1005 LET Y=1
1010 LET T=0
1015 DIM M(21,30)
1020 LET S=T
1025 FOR L=1 TO 21
1030 PRINT AT L,0;"..............
.....................";
1035 NEXT L
1040 GOTO 5
```

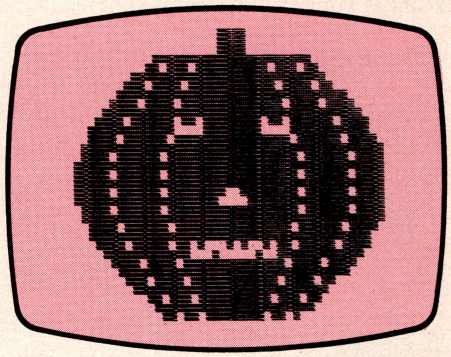
Robert J. Midura, 19 Merrifield St., Worcester, MA 01605.

The ZX Pumpkin

Mark L. Hall

8K ROM; 2K RAM; 1K RAM

This year you will not have to buy a pumpkin for Halloween, and yet you will be ready for the trick-or-treaters with your ZX/TS pumpkin. To set up your ZX/TS Jack-O-Lantern, type in the listing in Figure 1, put your computer in SLOW mode, and press ENTER.



The first six lines of the program draw a rough oval and paint it black. This, of course, is your ZX/TS pumpkin. The next four lines and the sub-routine at line 120 draw the lines of the pumpkin segments. Lines 50 and 53 draw the stem. The next two lines draw the eyes and nose. Lines 65-110 flash the message and teeth of the pumpkin in its mouth. The subroutine at line 100 is a half second pause so that your trick-or-treaters can read the message. Use BREAK to get out of the program.

The program was originally written on the ZX81 and expanded when I got my 16K RAM pack.

Mark L. Hall, 1705 11th St., Anacortes, WA 98221.

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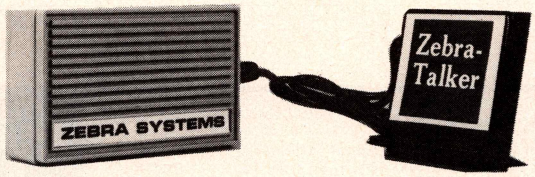

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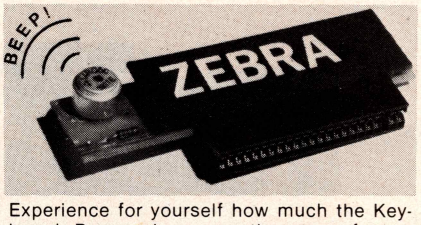

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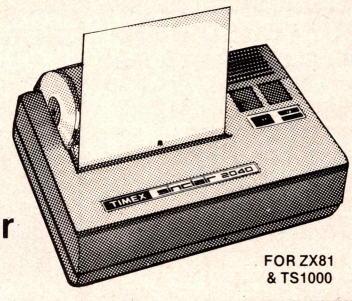

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CIRCLE 79 ON READER SERVICE CARD

To run in 1K enter the program in Figure 2, put the computer in SLOW mode, and hit ENTER. This version does not have the same features as the 2K version does, but it shows some good memory saving techniques.

Figure 1. 2K Version.

```
 10 FOR Y=5 TO 34
 15 LET X=30-20*SIN (Y/40*PI)
 20 FOR X=X TO 63-X
 25 PLOT X,Y
 30 NEXT X
 35 NEXT Y
 40 LET D=8
 43 GOSUB 120
 45 LET D=15
 47 GOSUB 120
 50 PRINT AT 3,D;"▀▀"
 53 PRINT AT 4,D;"▀▀"
 55 PRINT AT 8,11;"▀▀";AT 8,18
▀▀"
 60 PRINT AT 12,D;"▀ ▀"
 65 PRINT AT D,13;"▀▄▀▄▀"
 70 GOSUB 100
 80 PRINT AT D,13;" TRICK"
 82 GOSUB 100
 84 PRINT AT D,13;"  OR  "
 85 GOSUB 100
 87 PRINT AT D,13;"TREAT "
 90 GOSUB 100
 95 GOTO 65
100 FOR T=1 TO 25
105 NEXT T
110 RETURN
120 FOR Y=5 TO 34 STEP 2
125 LET X=30-D*SIN (Y/40*PI)
130 UNPLOT X,Y
135 UNPLOT 63-X,Y
140 NEXT Y
145 RETURN
```

Graphics notes:

```
50: INVERSE SPACE (2)
53: INVERSE SPACE (2)
55: INVERSE SPACE, 2, 1, 2, 1,
    INVERSE SPACE
60: 1, 2
65: 2, 3, 2, 2, 3, 1
```

Figure 2. 1K Version.

```
 10 FOR D=5 TO 34
 15 LET X=VAL "30-20*SIN (D/40*
PI)"
 20 FOR X=X TO 63-X
 25 PLOT X,D
 30 NEXT X
 35 NEXT D
 45 LET D=15
 50 PRINT AT 3,D;"▀▀"
 53 PRINT AT VAL "4",D;"▀▀"
 55 PRINT AT VAL "8",VAL "11";"
▀▀";AT VAL "8",VAL "18";"▀▀"
 60 PRINT AT VAL "12",D;"▀ ▀"
 65 PRINT AT D,VAL "13";"▀▄▀▄▀
"
 70 RAND EXP RND
 80 PRINT AT D,13;"  BOO "
 82 RAND EXP RND
 85 GOTO VAL "65"
```

Graphics notes:

```
50: INVERSE SPACE (2)
53: INVERSE SPACE (2)
55: 2, 1, 2, 1
60: 1, 2
65: 2, 3, 2, 2, 3, 1
```


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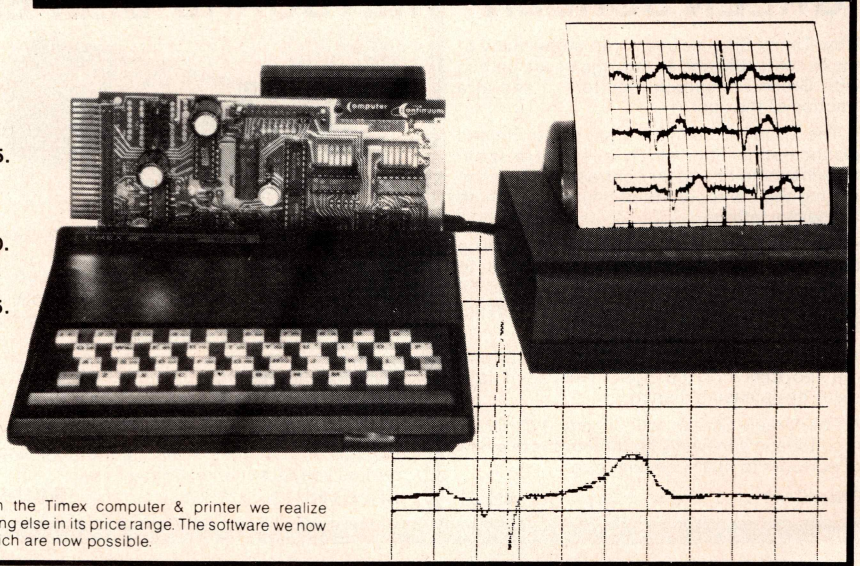

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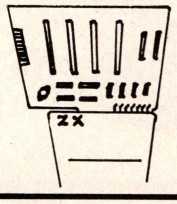

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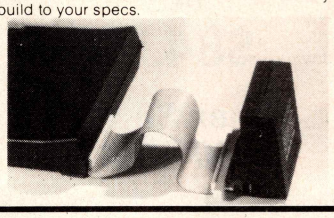

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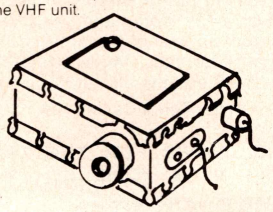

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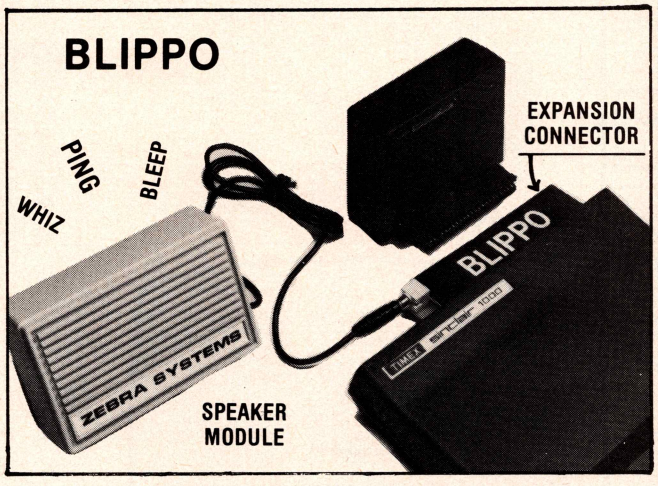

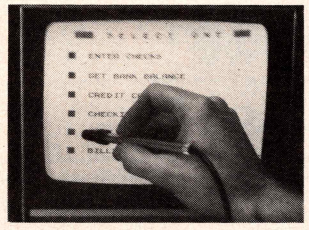

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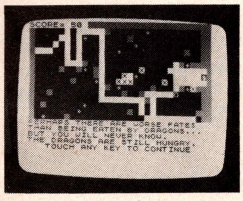

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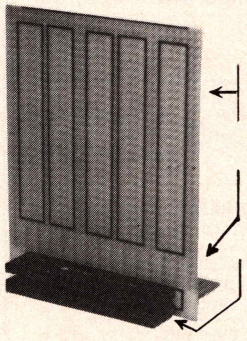

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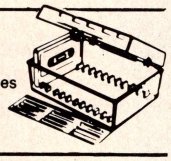

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CIRCLE 78 ON READER SERVICE CARD

Obtuse Triangle

Michael W. Schultz

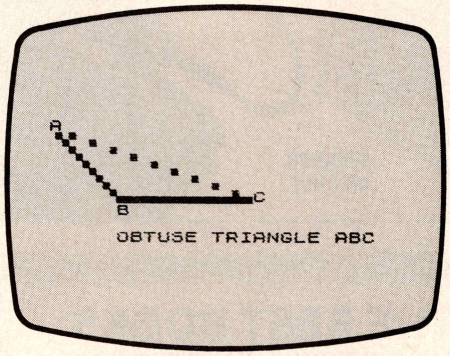
This program will draw an obtuse triangle, which is any triangle with an inner angle greater than 90 degrees. This is done by drawing line BC (lines 10-40) and then two oblique lines starting at each end of line BC and have them converge on point A (lines 50-100). The resulting drawing will be the obtuse triangle ABC.

Enter the program in Listing 1. Hit RUN and ENTER in either the SLOW or FAST mode. Notice the uneven spacing caused by the approximated PLOTting of X and Y in the long side AC. This can be remedied by inserting the lines in Listing 2.

Michael W. Schultz, 3650 Mossvale Dr. 20-D, Mobile, AL 36608.

Listing 1.

```
  5 REM "OBTUSE TRIANGLE"
 10 LET Y=20
 20 FOR X=20 TO 40
 30 PLOT X,Y
 40 NEXT X
 50 LET X=20
 60 FOR Y=20 TO 30
 70 PLOT X,Y
 80 PLOT 3*X-20,Y
 90 LET X=X-1
100 NEXT Y
110 PRINT AT 6,5;"A"
120 PRINT AT 12,10;"B"
130 PRINT AT 11,20;"C"
140 PRINT AT 14,10;"OBTUSE TRIA
NGLE ABC"
```



Listing 2.

```
 85 IF Y=30 THEN GOTO 110
 92 PLOT 3*X-19,Y
 94 PLOT 3*X-18,Y
```

Message Destruct

Joe Chaiet

Type in the program, and then SAVE it. After SAVEing, put the computer in SLOW mode and type RUN and ENTER. Try to incorporate this technique into your own programs.

Joesph Chaiet, 25 Cherry Hill Rd., New Paltz, NY 12561.


```
 10 PRINT "THIS DOCUMENT IS SEC
RET"
 20 PRINT "IT WILL SELFDESTRUCT
 IN "
 21 PRINT AT 5,5;"MEMORIZE THIS
 NOW"
 22 PRINT AT 9,5;"STATION 7 IS
READY"
 30 PRINT AT 1,27;"UNITS"
 40 FOR X=10 TO 0 STEP -1
 50 PRINT AT 1,24;X;" "
 60 NEXT X
 70 NEW
```

Train Revisited

John C. Hill

8K ROM; 2K RAM

SYNC 3:2 is the first issue I have seen, and I enjoyed the "Just for Fun" column. It is amusing and instructive—more fun than reading instructions.

However, the pixel that wanders off into the air above Joe Chaiet's train did not seem to go far enough. The train needs more "smoke." The program below is my doodling to that end. Type in the lines. Be sure you are in SLOW mode, and press RUN and ENTER. Watch the smoke!

John C. Hill, 4777 — 119th Ave., S.E., Bellevue, WA 98006.


```
  5 PRINT AT 4,4;"FIRE UP THE T
RAIN"
 10 LET A=20
 20 FOR B=1 TO 22
 25 PRINT AT 21,0;"
                  "
 30 PRINT AT A,B;"  O O  O "
 40 PRINT AT A-1,B;"
 50 PRINT AT A-2,B;"
 60 PRINT AT A-3,B;"
 70 PRINT AT A-5,B-1;"
 80 PRINT AT A-7,B-2;"
 90 PRINT AT A-9,B-3;"
 92 IF B<=5 THEN GOSUB 130
 94 IF B=5 THEN PRINT AT 6,18;"
/"
 95 IF B=5 THEN PRINT AT 7,7;"L
ET 'ER GO."
 96 IF B=6 THEN PRINT AT A-4,B+
5;"T"
 97 IF B=6 THEN PRINT AT A-5,B+
5;"O"
 98 IF B=6 THEN PRINT AT A-6,B+
5;"O"
 99 IF B=6 THEN PRINT AT A-7,B+
5;"T"
100 IF B=7 THEN PRINT AT A-4,B+
4;"
102 IF B=7 THEN PRINT AT A-6,B+
4;"
103 IF B=7 THEN PRINT AT A-7,B+
4;"
105 NEXT B
110 CLS
120 GOTO 5
130 FOR I=1 TO 18-3*B
140 NEXT I
150 RETURN
```

Strange Listing

David Farrell

Type in the following program. With the computer in either FAST or SLOW mode press RUN and ENTER. Observe the results.

David Farrell, PEAK Software, PO Box 8005, Suite 231, Boulder, CO 80306. Reprinted with permission from PEAK Software.


```
 10 LIST
 20 GOSUB 8000
 30 STOP
8000 LET AMEM=PEEK 16396+256*PEE
K 16397
8010 LET INCA=8020
8020 LET AMEM=AMEM+1
8030 IF AMEM=PEEK 16400+256*PEEK
 16401 THEN RETURN
8040 LET PKA=PEEK AMEM
8050 IF PEEK AMEM=118 THEN GOTO
 INCA
8060 IF PKA<128 THEN POKE AMEM,(
PKA+128)
8070 IF PKA>=128 THEN POKE AMEM,
(PKA-128)
8080 GOTO INCA
```

New Product Reports...

MKIV Keyboard

Just released this Spring is the MKIV Keyboard from E. Arthur Brown Company. Designed to upgrade the TIMEX-Sinclair 1000/ZX81 computer, this keyboard has some remarkable features. For one thing, it's made with very high quality keyswitches. The resulting action of the keys is just like that found on computers costing thousands more. Keys spring back up promptly after pressing... they never stick and always make the electrical contact needed for data input.

Another feature of the MKIV is the keytops themselves. The legends are installed with a sophisticated sublimation process. Rather than being painted, molded, or simply stuck on, they're actually impregnated into the plastic. This results in smooth faced keytops with legends that are virtually impossible to wear out. Each key is light gray colored with red and black legends.

The MKIV Keyboard Shown With Accessory Numeric Keypad.

There are 41 keys on the MKIV Keyboard. That's the standard 40 Timex-Sinclair keys plus a full length space bar. In the future, there will also be a 19 key numeric keypad accessory that will simply plug onto a jack in the side of the keyboard. (Note: Photo shows 12 key prototype keypad.) At present, the Numeric keypad is not yet available.

The price of the MKIV Keyboard is $89.95 plus $4.95 for shipping and handling. It carries a 90 day warranty and a 10 day, money back free trial. Contact E. Arthur Brown Company, 1702-SYN Oak Knoll Drive, Alexandria, MN 56308 to order. For those interested, the company also offers a free catalog of other TS1000/ZX81 Accessories.

High Speed Word Processing/Typing

Memo-Text is a new TS1000/ZX81 word processor from E. Arthur Brown Company that features a unique high speed character entry routine. You can type at full speed without having to wait for the computer to catch up. This speed is maintained until the screen fills and then your text just scrolls upward for more character entry.

Seikosha Printer Package

Another feature of the Memo-Text program is the ability to handle text and data files and to LOAD/SAVE them separately or all at once. Automatic printing of form letters, invoices, or other personalized mass correspondence is entirely within the scope of the system. Text formatting capabilities include fast scroll scanning of files, finding, exchanging, and moving blocks of text, amending, renaming, deleting text files, double sized letters, centering, pagination, headers, indentation, and several other features. All keys have full repeat capabilities with Memo-Text. Typing is just like using a typewriter. That is, all text is read by the printer as lower case unless shifted.

One very important consideration for potential Memo-Text buyers is the necessity of using it with a Memotech Centronics interface and full size printer. The program is designed to interact with the lower case capabilities of this interface and won't give a printout without it.

Memotext handles 16-64K of RAM and sells for $48.95 plus $3.95 for shipping and handling. Order from E. Arthur Brown Company, 1702-SYN Oak Knoll Drive, Alexandria, MN 56308. Those of you in need of a full size printer to use with Memo-Text might consider the Seikosha Printer package. It consists of an 80 character dot matrix printer, the Memotech Centronics interface, a hookup cable, and paper. To order, send an additional $339.95 plus $3.00 for shipping and handling.

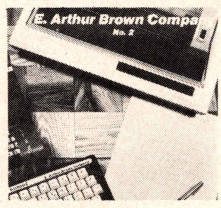
Business Programs That Read Data Tapes

Mega software is a new series of integrated software for the TS1000/ZX81 from E. Arthur Brown Company. It consists of programs that can actually read data tapes produced by other programs within the series. The data read is then used by the present program to update its own data files. For example, the invoicing program can be used to send bills to customers and then its data tape can be read by the accounts receivable program to update receivable files. You don't have to manually re-enter the billing information.

There are two integration groups in the Mega series. The Mega Master group consists of a desk top organizer, a spreadsheet, a word processor, a data base, a statistical analyzer, and a graph plotter. The Mega Wealth group is a small business set up. It consists of an invoicing program, accounts receivable, accounts payable, an inventory program, and a net earnings program which produces profit/loss statements and balance sheets. Each program works for 16-64K of RAM and sells for $20-$25. For more information write to E. Arthur Brown Company, 1702-SYN Oak Knoll Drive, Alexandria, MN 56308.

New Catalog Addresses Compatibility

A new peripheral and software catalog which addresses the problems of peripheral and software compatibility has just been announced by the E. Arthur Brown Company. According to their president, Eben Brown, peripheral compatibility is the future of TS1000/ZX81 computing. This new catalog tells you what works with what... saving you time and money by avoiding bad purchases. The catalog contains over 130 new products with in-depth descriptions and photos. For your free copy, write: E. Arthur Brown Company, 1702-SYN Oak Knoll Drive, Alexandria, MN 56308.



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perceptions

David Ornstein

The TS2000 Series

Overview

The TS2000 series of computers claims an extensive group of features1—oth hardware and software. The machines feature 24K ROM. The TS2048 has 16K RAM at its disposal while the TS2068 wields a well-utilized 48K RAM.

CPU and Operating System

The TS2000 uses a Z80A microprocessor running at 3.5MHz. It contains a few buffers, either 2 or 6 RAM chips, 2 ROMs, and the piece de resistance: a 64 pin custom chip designed by a few wizards at Timex.

The TS2000 features a full-sized 24K operating system (OS) which provides the Basic interpreter, full-channeled I/O facilities, and a function dispatcher that the user can call to have both simple and complex functions performed for him by the system, thus utilizing the system's facilities, and not duplicating them.

The TS2000's native language is Basic. It packs all the standard Basic statements including PRINT, INPUT, IF...THEN, FOR...NEXT, READ...DATA, etc. A full list of commands is given in Table 1. The functions are listed in Table 2.

The Display

The TS2000 supports several different display options. These include 32 column display, 64 column display, Hires screen of 256 x 192 pixels, Hires screen of 512 x 192 pixels, page switching, and an enhanced color-resolution mode. The machine provides connections for a B&W or color TV, an RGB monitor and composite video.

The Keyboard

The keyboard is a 42 hard-key keyboard, including a full-sized space bar and shift keys on both sides. The keyboard is full-sized and provides real tactile feedback (i.e., the button actually pushes down). The operating system provides for single key entry of all keywords.

Interface and Connectors

The cassette interface on the TS2000 is a step above the one on the TS1000, although the one provided with the TS1000 is sufficient for the type of jobs it

Table 1. List of Commands.

Beep x,y	Sounds a note through the loudspeaker whose duration is x seconds, and is y semitones above middle C (or below if y is negative).
Border x	Sets the border color to color x. Colors: 0 Black, 1 Blue, 2 Red, 3 Magenta, 4 Green, 5 Cyan, 6 Yellow, 7 White
BRIGHT x	Sets brightness level for subsequently printed characters. If x=0 then normal brightness; x=1 for bright; x=8 for transparent.
CAT "m","volspec"	Lists all files on the specified volume on the screen.
CIRCLE, x,y,z	Draws an arc of a circle whose center is at (x,y), and whose radius is z.
CLEAR	Deletes all variables, freeing the space that they occupied. Does RESTORE and CLS, resets the PLOT position to the bottom lefthand corner, and clears all pending GOSUBs.
CLEAR x	Like CLEAR, but, if possible, the RAMTOP pointer will be set to x, leaving all memory beyond location x out of the reach of BASIC.
CLOSE #c	Closes the specified stream, after flusing the appropriate buffers where necessary.
CLS	Clears the main screen.
CONTINUE	Continues executing the currently in-memory program where execution left off.
COPY	Sends a copy of the screen to the printer.
DATA $e_1,e_2, \ldots e_n$	Part of the data list. Must be in a program.
DEF FNv($v_1,v_2 \ldots v_n$)=e	User-defined function definition; must be in a program. Each of the v, v_1 to v_n must be either a single letter or a single letter followed by a dollar sign "$" for numeric and string arguments, respectively.
DELETE x,y	Deletes lines from the program whose line numbers range from x to y. If the x is omitted, then deletion starts at the beginning of the program. If the y is omitted, then deletion continues to the end of the program.

Table 1. Continued.

DIM v(x_1,x_2, . . . x_n)	Creates an array with the name v and sets it up as an array of characters of n dimension, which are: x_1,x_2, . . . x_n.
DIM v$($x_1$,$x_2$, . . . x_n)	Creates an array with the name v$ and sets it up as an array of characters of n dimension, which are: x_1,x_2, . . . x_n. This may be considered as an array of strings of fixed length x_n with n-1 dimensions x_1 . . . x_{n-1}.
DRAW x,y	Equivalent to DRAW x,y,0.
DRAW x,y,z	Draws a line from the current plot position moving x horizontally and y vertically relative to it, while turning it through an angle of z radians.
ERASE "m","filespec"	Removes specified file from the specified volume.
FLASH x	Defines whether subsequently printed characters will be flashing or steady. x=0 for steady, x=1 for flash, x=8 for no change.
FOR v=x TO y	Equivalent to FOR v=x TO y STEP 1.
FOR v=x TO y STEP Z	Deletes any simple variable v and sets up a control variable with the value x, limit y, step z, and looping address referring to the statement after the FOR statement.
FORMAT "m","volspec"	Formats the media on the specified volume, and assigns to it the specified volume name.
GOSUB x	Calls the subroutine at line x. Note that x may be an expression like 200*z+1000.
GOTO x	Jumps to line x, or, if there is no line x, to the first line following.
IF x THEN s	If x is true, (i.e., non-zero), then s is executed. Note that s includes all the statements to the end of the line.
INK x	Sets the ink (foreground) color of subsequently printed characters.
INPUT . . .	The ". . ." is a sequence of INPUT items, separated by commas, semicolons, or apostrophes. An INPUT item can be: (1) Any print item not beginning with a letter. (2) A variable name. (3) LINE, followed by a string-type variable name. The PRINT items and separators in (1) are treated exactly the same as in a PRINT statement except that everything is printed at the bottom of the screen.
INVERSE x	Controls inversion of subsequently printed characters. If x=0, then no inversion is selected and all characters are printed as ink color on paper color. If x=1, then inversion is selected and all subsequently printed characters are printed as paper color on ink color.
LET v=e	Assigns the value e to the variable v.
LIST	LIST 0
LIST x	Lists the program starting at line x, making x the current line.
LLIST	LLIST 0
LLIST x	Like LIST, but listing comes out on the printer instead of the screen.
LOAD f	Loads program and variables
LOAD f DATA ()	Loads a numerical array.
LOAD f DATA $()	Loads a string array.
LOAD f CODE m,n	Loads at most n bytes, starting at address m.
LOAD f CODE m	Loads bytes starting at address m.
LOAD f SCREEN$	Loads a screen picture. NOTE: For any of the above forms of the LOAD command, and also for the SAVE, MERGE, and VERIFY commands, if an* is inserted after the command (e.g., LOAD*f), then the operation will take place on a disk-like device, and not on the tape.
LPRINT	Like PRINT, but uses printer instead of screen.
MERGE f	Like LOAD, but merges instead of deleting memory first. All forms as per LOAD.
MOVE "m","old filespec", new filespec"	Renames the old file to the name new filespec.
NEW	Clears memory including program, variables, etc., up to RAMTOP.
NEXT v	Marks the end of a loop.
ON ERR CONTINUE	Continues execution of program where the last trapped error occurred.
ON ERR GOTO x	Sets up the system so that the computer will jump to line x if an error occurs. The programmer may then handle the trapped error as he desires.
ON ERR RESET	Turns off error trapping.
OPEN #c,"m","filespec"	Opens a stream identified by c and ties it to the device specified or file on the device specified.
OUT x,y	Outputs byte y to port x.
OVER x	Controls overprinting of subsequently printed characters.
PAPER x	Like INK, but controls paper (background) color.
PAUSE x	Stops operations for x sixtieths of a second, (i.e., PAUSE 120 waits for 2 seconds) or until a key is pressed. PAUSE 0 waits forever until a key is pressed.
PLOT x,y	Plots an ink spot at pixel (x,y); moves plot position.
POKE x,y	Places the value y in memory location x.
PRINT . . .	The ". . ." is a sequence of PRINT items, separated by commas, semicolons, or apostrophes. A semicolon between two items has no effect; it is used only to separate the two items. A comma outputs the comma control character, moving the print position to either column 0 or column 15. An apostrophe outputs an ENTER character. At the end of a PRINT statement, if it does not end with a semicolon, a comma, or an apostrophe, then an ENTER character is output.

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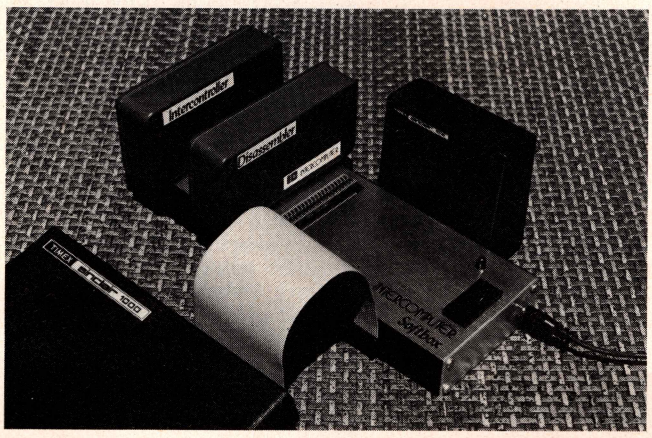

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CIRCLE 37 ON READER SERVICE CARD

Table 1. Continued.

	A PRINT item can be: (1) Empty (i.e., nothing). (2) A numerical expression. (3) A string expression. (4) AT x,y: sets the print position at line x, column y. (5) TAB x: Outputs spaces until column x is reached. (6) A color item which takes the form of a PAPER,INK, FLASH, BRIGHT, INVERSE or OVER statement. (7) A stream specifier (e.g., #6).
RANDOMIZE	RANDOMIZE 0
RANDOMIZE x	Sets the seed for the random number generator to x. If x=0, then the seed is given the value q, where q is the number of seconds times 60 that the computer has been on.
READ $v_1,v_2, \ldots v_n$	Read values for the specified variables from the DATA list.
REM . . .	No effect. REMark or REMinder. The ". . ." can be any sequence of characters except ENTER. This includes ":" so no statements are possible after the REM on the same line.
RESET (#c) (*)	The arguments in parentheses are optional. If no arguments are given, then the RESET command initializes any new devices it finds. If a stream number is given, then the channel associated with the specified stream is reinitialized. The RESET * command does the equivalent of turning the machine off and then on again.
RESTORE	RESTORE 0
RESTORE x	Restores the data pointer to the first DATA statement in a line with a number at least n: the next READ will start reading there.
RETURN	Return from subroutine.
RUN	RUN 0
RUN x	CLEAR, then GOTO, x.
SAVE f	Saves the program and variables with their values.
SAVE f LINE x	Saves the program and variables so that, if they are loaded, there is an automatic jump to line x.
SAVE f DATA ()	Saves a numerical array.
SAVE f DATA $()	Saves a character array.
SAVE f CODE m,n	Saves n bytes starting at address m.
SAVE f SCREEN$	Saves a screen picture.
SOUND x,y;a,b,c,d . . .	Sets register(s) to specified value(s) in sound generator.
STOP	Stop the program.
VERIFY	Like LOAD except that the incoming data is not loaded into memory, but compared against what is already there. An error is given if any comparison shows a difference. All forms as per LOAD.

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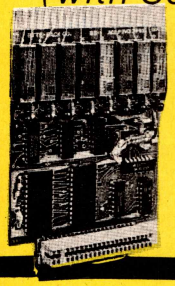

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Table 2. List of Functions.

ABS x	Absolute magnitude.
ACS x	Arccosine in radians.
x AND y	x if y < > 0: 0 if y=0
x$ AND y	x$ if y < > : "" if y=0
ASN x	Arcsine in radians
ATTR (x,y)	Attributes for character on screen at position x,y
BIN x	Yields the decimal of the binary number x. (i.e., PRINT BIN 10101010 prints 170).
CHR$ x	The character whose code is x.
CODE x$	The code of the first character in x$
COS x	Cosine in radians
EXP x	e^x
FN	FN followed by a single letter calls up a user-defined function.
FREE	Returns the number of bytes of memory available to the user.
IN x	Reads the byte at I/O port x.
INKEY$	The character currently being pressed key.
INT x	Integer (in characters) of x$.
LN x	Natural logarithm (to base e).
NOT x	0 if x < > 0; 1 if x=0
x OR y	1 if b < > 0; x if b=0
PEEK x	The byte stored in memory location x.
PI	3.14159265 . . .
POINT (x,y)	1 if the pixel at x,y is ink color; 0 if it is paper color.
RND	A random number x, such that 0 < x < 1
SCREEN$ (x,y)	The character that appears at character location x,y on the screen.
SGN x	Signum: the sign -1 for negative, 0 for zero or +1 for positive) of x.
SIN x	Sine x.
SQR x	Square root.
STICK (x,y)	Reads stick number y. Reads button or joystick position according to y.
STR$ x	The string of characters that would be displayed if x were printed.
TAN x	Tangent.
USR x	Calls the machine language routine at address x.
USR$	The address of the first of eight bytes describing the bit pattern for a user defined character.
VAL x$	Evaluates x$ as a numerical expression.

performs. The TS2000, however, is designed to be able to handle some larger and more involved tasks. Its cassette interface scheme has been designed to meet, functionally, with the needs of the system and its user. The cassette runs at about 1500 bps (bits per second). This means that the user can save 16K in approximately 87 seconds1—bout five times faster than the speed of the interface on the TS1000.

Because of the difference in the actual hardware interface between the two machines, TS1000 cassettes cannot be read into a TS2000 and TS2000 cassettes cannot be read into a TS1000. The interface is *very* reliable. I have been using the machine for about 10 months by now, 8-15 hours a day, and I have had perhaps a half dozen errors while trying to LOAD a program into the TS2000.

The TS2000 has two connectors available for adding joysticks (one or two) to the system. The industry standard 8-position joysticks connect to the system via a 9-pin D-type connector. These are the same joysticks used by Atari and many other manufacturers.

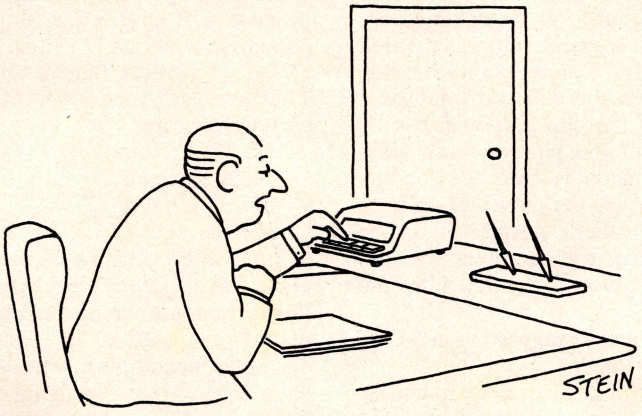
Bank Switching

The most innovative feature of the TS2000 is bank switching. This is a means of expanding the computer's address space. Through the flexible scheme that Timex has designed, the TS2000 has the ability to access up to 256 * 64K, or 16 million bytes of memory. Is anyone other than me waiting to see who develops the "16 megabyte RAM pack" first?

Conclusion

All in all, the TS2000 is a very powerful system. With the above described and below detailed features, plus a few extras, the system packs quite a load at a suggested retail price of $199.95 for the TS2068 and $149.95 for the TS2048.

In the next "Perceptions" I will discuss in detail the graphics capabilities and the memory-expanding bank switching technique used by Timex to enhance the functionality of the machine. ■



"Miss Hendricks, I'm ready to ingest, process and generate information and knowledge."

Read This First

Before you enter the programs in this issue, please note:

All programs require the **8K ROM** and **16K RAM** unless indicated otherwise at the top of the first page of the article.

NEWLINE and **ENTER** are used interchangeably.

A letter after a number shows the type: b for binary, d for decimal, and h for hexadecimal.

In PRINT statements:

#: Enter a necessary space.

A (32): The underline means use the graphic on that key. The number in () tells how many times.

Ā: The overline means use the key in inverse.

INPUT: An underlined *word* found on the keyboard should be not be spelled out. Enter it directly. If it will not ENTER, hit THEN and then the keyword you want; backspace, delete THEN, and continue entering the line. This memory saving technique may be disregarded if you have enough RAM.

hardware tips

Robert D. Hartung

Ed.—**A WORD OF CAUTION:** *Any hardware project must be approached with extreme caution.* **SYNC** *cannot be responsible for any problem that may arise from attempting hardware projects. Obviously, any damage to your computer can be costly in time and money. If you do encounter a problem, write a clear description of the problem either to* **SYNC** *or to the author and include an SASE. We will make every effort to find a solution.*

For our "Hardware Tips" department this time we have asked Robert Hartung to comment on some letters from our readers. Since he had only the information given in the letters to work with, he cannot guarantee his answers. Rather his responses should be regarded as suggestions to help look for the answers. In most cases more details would be required in order to give a fuller answer. We welcome comments from readers on these problems also.

ROM and RAM Problems

No Cursor

I added the 8K ROM and 16K RAM pack to my ZX80. With the 4K ROM/16K RAM pack, the cursor appears; however, with the 8K ROM/16K RAM pack, the cursor does not appear.

James Kinsella
2846 St. Paul Blvd.
Rochester, NY 14611

Comment:

1) Examine the 8K ROM carefully with a magnifying glass to make sure none of the pins are loose, broken, buckled, or bent under or to the side, and that all are entering properly into their respective positions in the IC socket, with the notched end of the ROM to the notched end of the socket as was the old ROM.

2) Guard against static damage to the ROM chips. If you do not have a grounding clip for ICs, it is good practice that the conductive foam wrapper be laid out next to the IC socket on the PC board before removing the old ROM from the socket and the new ROM from the foam. After *gently* lifting the old ROM with a very small screwdriver under each end, but with all the pins *still touching* the socket, place your little finger on the modulator shield, your middle finger on the foam, and lift the old IC out with your thumb and forefinger at each end of the IC, not touching any pins. Place it on the foam and pick up the new ROM the same way. It may be necessary to apply considerable pressure sideways, carefully and evenly, against all the pins at one side of the IC in order to line up all the pins on the other side for proper insertion.

A large (2" or larger) jaw-type paper clip, such as those made by Esterbrook and sold for about $1 in larger stationery stores, makes a good substitute for a regular IC clip. Connect a grounding jumper between the clip and modulator shield and put the clip jaws over the IC module and on the pins on both sides before removing the IC from the conductive foam or prying the old ROM up from its socket. If properly positioned on the pins, the clip jaws will compress pin-rows toward each other for entry into the socket.

3) Herb Hornung's suggestion in *SYNC* 2:4, p. 76, may apply.

4) If the computer still does not work and if the ROM has not been subjected to static damage in handling after removing it from the conductive foam, it is possible that you have received a defective ROM.

Unconnected Input on the RAM Pack

On the Sinclair RAM pack one of the inputs to IC 2 (7400) pin 10 is not connected to +5V or ground. This is an unused gate on the chip and could contribute to some RAM pack difficulties.

Rois R. Harder
895 Shakespeare Ave.
North Vancouver, B.C.,
Canada V7K 1E7

Comment:

Sinclair's 1981 schematic for the 16K RAM shows pin 8 of the 74LS00 going to pin 1 of IC 3 and IC 4, and pins 9 and 10 of IC 2 both going to RFSH port of the edge connector.

RAM Pack Connections

The ZX81 performance with the Sinclair 16K RAM pack was so erratic that it was almost impossible to obtain any consistant results. Repeated cleaning of the contacts resulted in only temporary improvement. I have, however, improved performance immeasureably by a simple procedure. I inserted a short piece of copper wire about 1/4" long under each of the 44 contact fingers on the RAM. The wire was from two or three one watt carbon resistors.

P. W. Andrew
4824 E. Grant
Fresno, CA 93727

Comment:

Some later versions of the 16K RAM pack have greatly increased contact-finger pressure on the edgeboard connector compared to the earlier models. This is to accomplish what you seem to have achieved by wedging them more tightly to the edgeboard connecting strips.

Robert D. Hartung, PO Box 125, Palmyra, NY 14522.

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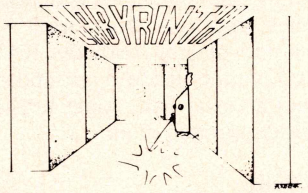

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Authors note to players — I wrote this one with a concordance in hand. It is very accurate — and a lot of fun. It was nice to wander around the ship instead of watching it on T.V.

DERELICT by Rodger Olsen and Bob Anderson — For Wealth and Glory, you have to ransack a thousand year old space ship. You'll have to learn to speak their language and operate the machinery they left behind. The hardest problem of all is to live through it.

Authors note to players — This adventure is the new winner in the "Toughest Adventure at Aardvark Sweepstakes". Our most difficult problem in writing the adventure was to keep it logical and realistic. There are no irrational traps and sudden senseless deaths in Derelict. This ship was designed to be perfectly safe for its' builders. It just happens to be deadly to alien invaders like you.

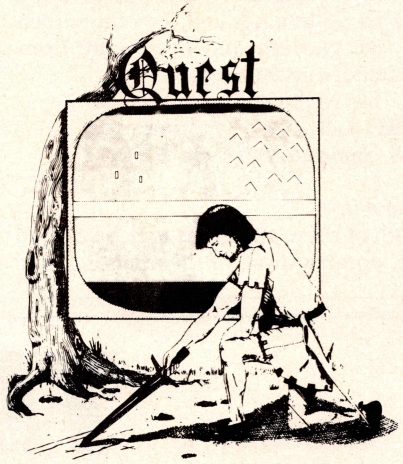
Dungeons of Death — Just for the 16k TRS-80 COLOR, this is the first D&D type game good enough to qualify at Aardvark. This is serious D&D that allows 1 to 6 players to go on a Dragon Hunting, Monster Killing, Dungeon Exploring Quest. Played on an on-screen map, you get a choice of race and character (Human, Dwarf, Soldier, Wizard, etc.), a chance to grow from game to game, and a 15 page manual. At the normal price for an Adventure ($19.95 tape, $24.95 disk), this is a giveaway.

PYRAMID by Rodger Olsen — This is one of our toughest Adventures. Average time through the Pyramid is 50 to 70 hours. The old boys who built this Pyramid did not mean for it to be ransacked by people like you.

Authors note to players — This is a very entertaining and very tough adventure. I left clues everywhere but came up with some ingenous problems. This one has captivated people so much that I get calls daily from as far away as New Zealand and France from bleary eyed people who are stuck in the Pyramid and desperate for more clues.

MARS by Rodger Olsen — Your ship crashed on the Red Planet and you have to get home. You will have to explore a Martian city, repair your ship and deal with possibly hostile aliens to get home again.

Authors note to players — This is highly recommended as a first adventure. It is in no way simple—playing time normally runs from 30 to 50 hours — but it is constructed in a more "open" manner to let you try out adventuring and get used to the game before you hit the really tough problems.



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RAM Pack Crashes

Until recently I have had no problem with my ZX81 with the RAM pack attached. Now the computer crashes while I am typing in a problem. The screen goes blank and the program is erased. After unplugging and plugging it in again, it works fine for 10-15 minutes. I have taped the RAM pack securely in place so it cannot move. I do not think the problem is overheating because sometimes it will work for an hour or two before crashing, but other times it will crach almost immediately after running.

Brent Helms
5411 SW 96 Ave.
Miami, FL 33165

Comment:

Should a Sinclair 16K RAM pack that works well on an ZX80 with the 8K ROM have any problems on a TS1000? Mine operates 5-6 minutes and then the screen fills with garbage and eventually flops over full of curved lines.

Jim Mahoney
RD 4, Box 247
S. Salem, NY 10590

Comment:

Both of these situations may be caused by a combination of overheating and edgeboard connection problems.

The overheating can best be solved with an external voltage regulator (see *SYNC* 3:2, p. 68). Since the regulator requires nearly 2V offsetting voltage, some ZX/TS power supplies may not provide the 9V output under load required for SAVE mode on some ZX/TS computers.

However, by substituting a DPDT switch for the SPST shown in the *SYNC* article and connecting the regulator input to lug 1 of the first set of switch-poles and the regulator output to lug 2 (C) of this first set of poles, the external regulator is shunted out of the circuit for full voltage in this switch position which is used in SAVE mode. For the 7V output used for cooler operation in all other modes than SAVE, connect the regulator GND terminal (3) to lug 2 (C) of the second set of switch poles and connect a 330 resistor in series between lug 3 of this second set of poles and ground (-). The shunt resistor is omitted. Do not use this configuration with power sources greater than 13 WVDC.

The edgeboard connector problems can occur because of oxidation of the soldercoating on the connector strips even when mechanical stability has been secured. Swab both sides of the connector strip liberally with TV contact cleaner/lubricant and slide the RAM pack on and off several times. Insert the pack fully, then back it off just enough that the contact fingers are not pried open by pressure of the pack case against the computer case.

RAM pack wobble may be prevented in various ways: 1) Mount both the computer and the RAM pack on a flat mounting board (3/4" chipboard is fine) with a bit of picture-mounting tac-dough under each corner of the computer and under the RAM pack legs will ensure they do not move relative to each other. 2) Some have had success also by putting extra-high pads under the computer so that the RAM pack hangs free from the connector. 3) Ribbon-cables with connectors on each end also work well. 4) Hard-wiring and placing both the RAM pack and computer inside a grounded metal cabinet as used with some keyboards is the best approach of all.

New Pads

My answer to RAM pack wobble was to get some sticky pads at Radio Shack (1/2" in diameter by 1/8" thick) to replace the standard pads. At the keyboard end I put 2 pads 1/2" closer to the expansion port. At the port end, they are 1/2' O.C.

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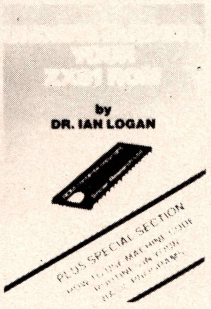

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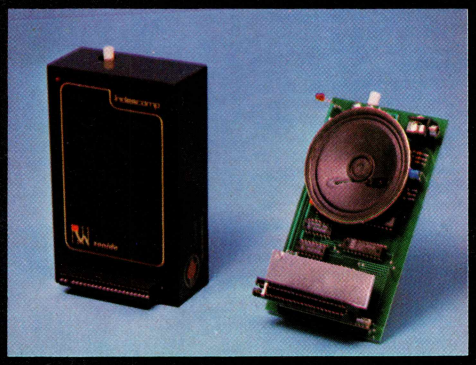

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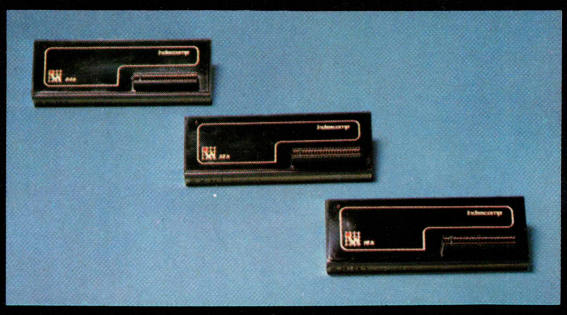

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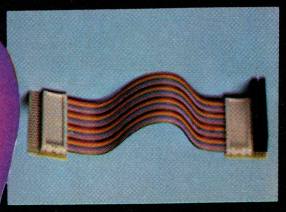

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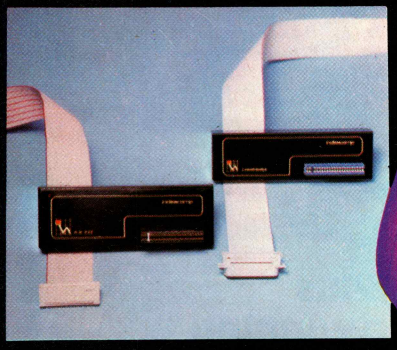

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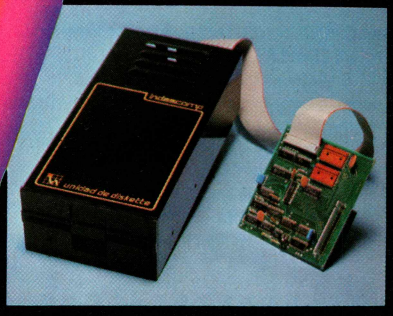

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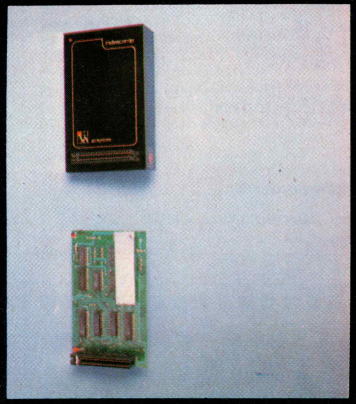

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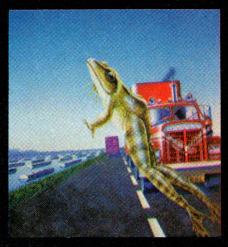

CROAKA CRAWLA $12

Author: **John Field**

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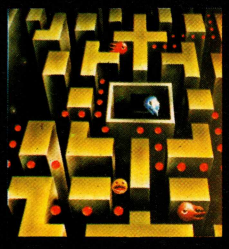

MUNCHESS $12

Author: **A. Laird**

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PIONEER TRAIL $12

Author: **Marion Stubbs**

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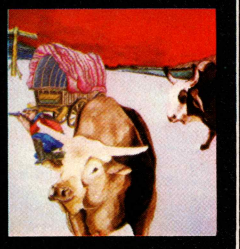
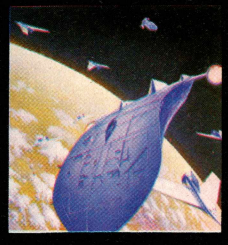
PIONEER TRAIL



GALAXIANS & GLOOPS



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Author: **T. Beckwith**

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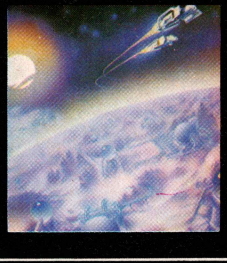

QS SCRAMBLE $12

Author: **Dave Edwards**

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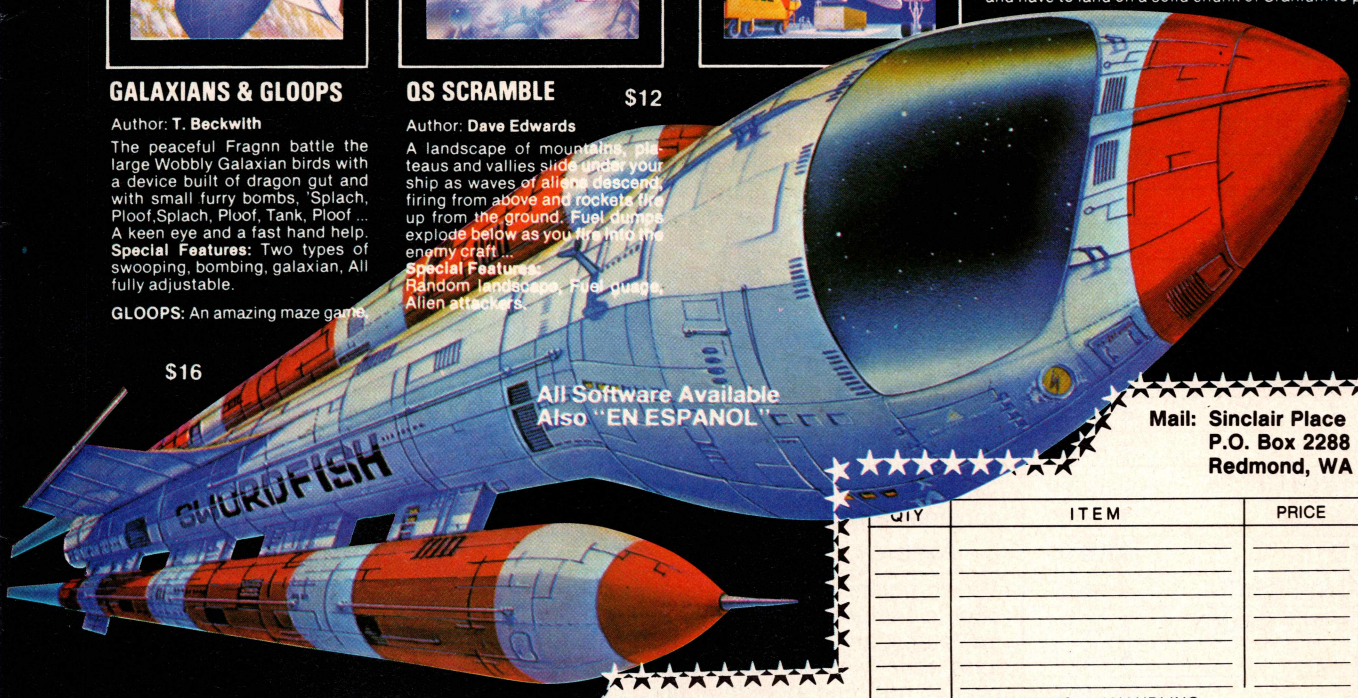

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from the edge of the computer. On the other axis they are in line with the originals.

Andreas Rainwater
Rt. 1, Box 57-A
Coyle, OK 73027

Screen Display Problems

RAM Pack Buzzing Sounds

Raymond Fowkes in *SYNC* 2:4 suggested soldering two foil tabs on the underside of the PC board together with a short piece of wire to solve the problem of the buzzing sounds caused by the 16K RAM pack. Is this safe for the computer?

John Torrance
41 Alpine Pl.
Kearny, NJ 07032

Comment by Raymond Fowkes:

I learned that there was more to the story after I wrote to *SYNC*. My ZX81 was a kit, and it seems that Sinclair left out the instructions for installing the long thin metal grounding strap in the computer (not the RAM pack as a few thought). This raised the resistance in the 0 volt trace just enough to cause noise when the extra load from the RAM pack was added.

Therefore, anyone who does not have a long thin silver strip of metal running across the noncomponent side of the ZX81 may solder a wire to the two large pads of bare foil (labeled TB in Figure 2) on the underside of the PCB. One is next to the edge connector where the RAM pack is attached; the other is in the opposite corner next to the regulator (the 3-prong IC on the component side with the big metal heatsink). Factory assembled units should be OK in this respect, but those with hardware experience who are very careful could further reduce the noise by connecting wires in parallel with other traces, especially the one carrying 5V to the edge connector though this is not advised because of various risks.

Comment:

I referred the above question to Raymond Fowkes for clarification. I note from letters by owners of factory built ZX81s that some may have defective solder connections on this strip or else it may not be making proper contact with the metalized coating inside the case. The result is increase TVI, which the 16K RAM pack may raise to an even higher interference level. The solution is to make sure that all the solder connections are secure by reheating them and ensure that the strip is making contact with the case by arching it slightly higher above the board in the center. However, this will not cure the noise which originates in the voltage converter in the RAM pack itself. This feeds back transient noise into the computer power line as well as radiating RFI if all the grounding strips in the RAM pack are not making proper contact with the metalized coating in the case. Some 16K RAM packs, such as Memotech, do not use this power conversion and so produce less RFI.

The solution involves the adding of suppression around the Zener diodes which originate the most of this noise, but, unless the proper components are identified, the RAM could be disabled. A thin metal box formed to fit over the RAM case and grounded to the TV modulator case (but not touching the edge-board connector) will alleviate the RFI which affects the TV display. Heavy aluminum foil may be used. (See Bruce Kirk's letter.)

Dark Bands and Noise

The 16K RAM from Apropos Technology worked well on my ZX80 except for considerable noise in the TV display. By covering the ZX80 and module with aluminum foil grounded to the coax to the TV, I reduced the noise. However, when I used the 16K on the TS1000, two darker horizontal "bands" appeared in the TV display, moving slowly and evenly downward. The display itself (symbols and spacing) was not affected although these bands overloaded the TV sync and caused minor "tearing" of the picture.

Bruce P. Kirk
RR 4, Box 4033 B
La Plata, MD 20646

Comment:

Your "fix" of the noise problem with the foil shows the need for more adequate shielding in the RAM pack case unless the noise source is corrected by suppression at the internal power converter of the RAM.

The moving horizontal bands in the TV display may be partially from transients going back into the computer along the 9V bus from this power converter noise. Usually such bands indicate inadequate filtering of the DC power supply. This may easily be corrected by connecting a 2200 uF 35WVDC capacitor between the DC power cord leads. However, the loss of TV sync and tearing may indicate a combination of RFI, noise transients on the power bus of the computer, and excessive ripple in the power input. You may have to work on these one at a time.

RFI Trash

The RFI trash on my portable TV screen is very annoying. However, on my 17" TV the screen is crystal clear. What does my large TV have that my small one does not? Is there a circuit I can build for

CIRCLE 65 ON READER SERVICE CARD

my small set to solve the problem?

Rick Goulian
1525 N. Euclid, Apt. 121
Tucson, AZ 85719

Comment:

The tuning section and selectivity of the 17" TV may be better or have better shielding. Some TVs are designed for better RF harmonic rejection than others.

1) Be sure that the built-in antenna or rabbit-ears are completely disconnected from the TV input terminals and disconnect the CATV or other antenna leads. Relocate them and the TV power cord and the computer power cord as far as possible from each other.

2) Sometimes it helps to put 2 or 3 ferrite sleeves on both these power cords, respectively, as near the TV and the computer as possible. Wind the cord through the hole several times. (Radio Shack has assorted packages.)

3) The length of the cable between the computer and the TV may be critical with some tuners. The 48" length supplied with the computer is designed to be one-fourth wave-length at the pix frequency of TV channel 3 for maximum signal-transfer to noise ratio. The TV/computer switch box supplied lengthens this enough to provide a match for TV channel 2, in length and in impedance. Clean the switch contacts by spraying TV contact cleaner/lubricant liberally inside the box and working the switch back and forth.

4) Some 16K RAM packs emit excessive RFI back to the computer and also as radiation. Use the computer only on a non-metallic desk or table, or place it on a sheet of heavy foil grounded to the outer conductor of the TV cable plug or to the TV modulator case. It may help to fold the foil up and around the RAM pack also. (See Bruce Kirk's letter.)

5) When severe TV interference occurs, either from RFI from the computer/peripherals or from being in a strong signal area on the channel used by the VHF modulator or on an adjacent channel, the only real solution may be to replace the VHF modulator with a UHF modulator (see *SYNC* 3:1, p. 72). Try adding a short patch cable (4-6") to the existing TV cable if the UHF signal to the TV seems to be down.

6) Another solution is get a well-shielded cord for connecting the computer to the TV.

A ZX81 and an 18 year old Sony

My ZX81 kit works only with my 18-year old Sony portable TV. It works best with the gain control turned down. With other TVs the ZX81 seems to be putting out too much signal and overdrives the screen resulting in an unusable, cross-hatched pictures. I have tried turning down the AGC on several TVs as well as a different TV/game box to no avail.

Ross A. Rainwater
305 Regal Dr.
Lawrenceville, GA 30245

Comment:

The cross-hatching would indicate the problem is RFI rather than overdriving, which in effect is superimposing one or more spurious signals to the TV over the top of the desired one. The Sony gain control apparently reduces these other signals enough that only the legitimate one is visible in the display. Some TVs have better front-end shielding and selectivity and adjacent-signal-rejection than others, which may account in part for the difference in those you have tried.

Small coupling trim-pad capacitors placed in each side of the TV lead-pair in the TV/game switch box might help tune out and attenuate the unwanted signals. Drill small holes in the box directly over the trim-pads so they can be adjusted with the box closed, using a non-conducting tool.

A better solution, however, would be to prevent or shield off as much of the interference as possible at the source. See above for suggestions for RFI problems. ■

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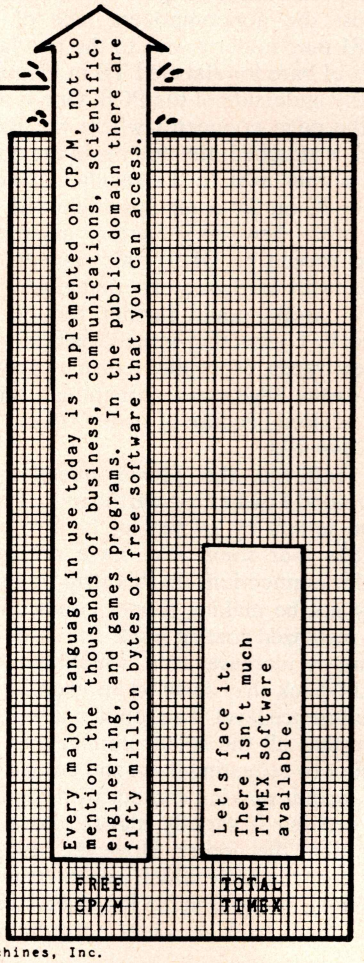

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CIRCLE 3 ON READER SERVICE CARD

in and out of sync

David Grosjean
David H. Ahl

Making Borders and a Bouncing Ball

David Grosjean

We will begin our series on comparative programming with the Panasonic JR-200, the Vic-20, and the TS1000. Our first exercise is to develop step by step the routine for creating a border around the screen and then vary its dimensions. Our second exercise is develop a routine for a bouncing ball. Both exercises are useful in certain types of games.

Making Borders

Our first exercise is easy on the JR-200 and TS1000 because they have the PLOT command, while the Vic-20 does not. First, let's look at the PLOT command.

On the JR-200, the X axis is along the top (from 0 to 63), and the Y axis is down the left (from 0 to 47). On the TS1000, the X axis is along the bottom of the screen (from 0 to 63), and the Y axis is up the left side (from 0 to 43).

Let's PLOT a single point at the center of the screen. Notice that a rather complicated method of cursor movement is the simplest method for the Vic, while the JR-200 and TS1000 use the easier PLOT command.

JR-200:
```
PLOT 31,23
```
TS1000:
```
PLOT 30,21
```
VIC-20;
```
 5 PRINT ""#""
10 FOR I=1 TO 11
20 PRINT ""####"";
30 NEXT I
40 PRINT ""###""
```

Line notes for the Vic:

5: The control character is a clear screen character.

10: The control characters in the quotation marks are: reverse on, cursor right, cursor down, reverse off.

40: The control characters are: reverse on, one space, reverse off.

To light up this point without any other printing on the screen, use these short programs:

JR-200:
```
10 CLS
20 PLOT 31,23
30 GOTO 20
```
TS1000:
```
10 CLS
20 PLOT 30,21
30 GOTO 20
```

To the Vic version above, add 50 GOTO 50. This does not keep printing the point over and over again, but it does avoid printing on the screen.

Now, how can we expand this one point to a whole line? One way would be to use a series of PLOT statements. For example:

JR-200:
```
10 CLS
20 PLOT 1,23
30 PLOT 2,23
40 PLOT 3,23
•
•
640 PLOT 63,23
```
TS1000:
```
10 CLS
20 PLOT 1,21
30 PLOT 2,21
40 PLOT 3,21
•
•
640 PLOT 63,21
```

Obviously, this is very inefficient and cumbersome. We could use a FOR-NEXT statement instead:

JR-200:
```
10 CLS
20 FOR X=0 TO 63
30 PLOT X,23
40 NEXT X
50 GOTO 20
```
TS1000:
```
10 CLS
20 FOR X=0 TO 63
30 PLOT X,21
40 NEXT X
50 GOTO 20
```
Vic-20:
```
 5 PRINT ""#""
10 FOR I=1 TO 11
20 PRINT ""###"";
30 NEXT I
40 FOR I=1 TO 22
50 PRINT ""###"";
60 NEXT I
70 GOTO 70
```

Line notes for the Vic:

5: Control character is to clear screen.

20: Control characters are: reverse on, cursor down, reverse off.

50: Control characters are: reverse on, one space, reverse off.

These programs simply draw a horizontal line and, when finished, draw it over and over again.

As long as we are varying X from the left to right of the screen, why not draw two horizontal lines at once, one at the top and one at the bottom? Here are the programs to do this:

JR-200:
```
10 CLS
20 FOR X=0 TO 63
30 PLOT X,0
40 PLOT X,47
50 NEXT X
60 GOTO 20
```
TS1000:
```
10 CLS
20 FOR X=0 TO 63
30 PLOT X,0
40 PLOT X,43
50 NEXT X
60 GOTO 20
```
Vic-20:

On the Vic, drawing one line using cursor movement is fairly easy, but when you get into more than that, it is easier to POKE into the screen memory. From now on, we will only use POKE. In the following program, SM is the start of screen memory, and the control character in line 10 is the clear screen control character.

In lines 40 and 50, the second POKE command POKEs into the color memory. This is to insure that what you POKE into the screen memory is not the same color as the background. Now that we are POKEing, there are no X,Y coordinates; each space on the screen is numbered consecutively, so our equations for the correct display must change.

```
 10 PRINT ""#""
 20 SM=7680
 30 FOR I=0 TO 21
 40 POKE SM+I,160:POKE 3
 8400+I,2
 50 POKE SM+484+I,160:PO
 KE 38884,2
 60 NEXT I
```

But we want to have vertical borders, too. We can use the same loop by adding two more PLOT statements.

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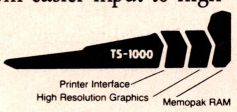

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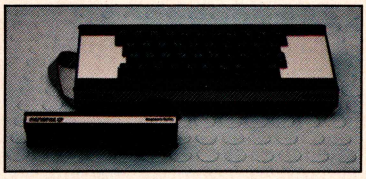

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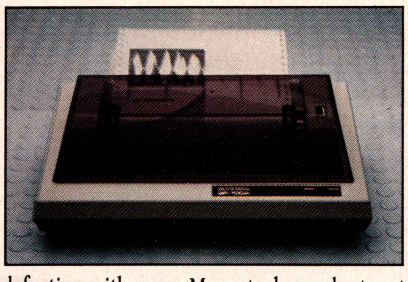

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JR-200:

```
10 CLS
20 FOR X=0 TO 63
30 PLOT X,0
40 PLOT X,47
50 PLOT 0,X
60 PLOT 63,X
70 NEXT X
80 GOTO 20
```

TS1000:

```
10 CLS
20 FOR X=0 TO 63
30 PLOT X,0
40 PLOT X,43
50 PLOT 0,X
60 PLOT 63,X
70 NEXT X
80 GOTO 20
```

But a value error occurs in line 50 because X exceeds the maximum Y value that can be plotted. This can be fixed easily be adding a line before 50 to test for a value of X over the maximum.

JR-200: `45 IF X>43 THEN 70`
TS1000: `45 IF X>47 THEN GOTO 70`

This final program is one of the shortest ways to draw a border. Of course, if you are using this routine in another program, you would not need line 80.

Vic-20:

On the Vic letting the overflow mistake occur as on the other machines would be too risky to the program in memory because we are POKEing. Therefore we must add the overflow checking line (line 45) before we make a possibly disastrous mistake. Several times while we were developing this routine, we completely lost control of the computer and simply had to turn it off and on again. Needless to say, this required much retyping. (If you are writing your own program, you cannot write the test line first; you must do it through testing.)

```
 10 PRINT ''#''
 20 SM=7680
 30 A=4
 40 FOR I=0 TO 22
 45 IF I>=22 THEN 70
 50 POKE SM+I,160:POKE 3
8400+I,A
 60 POKE SM+I+484,160:PO
KE 38884+I,A
 70 POKE SM+I*22,160:POKE
38400+I*22,A
 80 POKE SM+I*22+21,160:
POKE 38421+I*22,A
 90 NEXT I
100 GOTO 100
```

On the JR-200, color can be added easily by adding a line 5. Try these:

```
5 COLOR 1
5 COLOR 3,5
5 COLOR 2,6,3
```

To add a variety of color to the Vic, change line 30 to:

```
30 A=INT(7*RND(0))
```

In the previous program, instead of having the border print at the edges of the screen, it is possible to let the non X value vary. We will let the distance or increment from the edge of the screen be I. The value of I can be used as the coordinate for the top and left side; however, the right side must be defined as 63-I (JR-200 and TS1000) and the bottom as 47-I (JR-200) or 43-I (TS1000).

This program uses these relationships to draw a series of concentric borders which start at random points in the upper left quarter of the screen. Note that the test to see if the maximum Y value has been exceeded is changed somewhat. Can you explain why?

JR-200:

```
 10 CLS
 20 RANDOMIZE
 30 I=INT(23*RND(0))
 40 COLOR (INT(8*RND(0))
 50 X2=63-I
 60 Y2=47-I
 70 FOR X=I TO X2
 80 PLOT X,I
 90 PLOT X,Y2
100 IF X2-X<=16 THEN 130
110 PLOT I,X
120 PLOT X2,X
130 NEXT X
140 GOTO 30
```

TS1000:

```
 10 CLS
 20 RAND
 30 LET I=INT (RND*22)
 50 LET X2=63-I
 60 LET Y2=43-I
 70 FOR X=I TO X2
 80 PLOT X,I
 90 PLOT X,Y2
100 IF X2-X<=20 THEN GOTO 130
110 PLOT I,X
120 PLOT X2,X
130 NEXT X
140 GOTO 30
```

Again, since we are not using a coordinate system on the Vic, the equations to figure out the parameters of each border are different from the equations of the TS1000 and JR-200. Can you figure out how the equations work? Tip: lines 100 and 110 draw the horizontal lines. CM is the start of color memory; SM is the start of screen memory; B is a random color; I is a random starting point for the borders. Remember also that the Vic screen is 22 by 23 (0 to 21 and 0 to 22).

```
 10 PRINT ''#''
 20 SM=7680
 30 CM=38400
 40 I=INT(11*RND(0))
 50 B=INT (8*RND(0))
 60 X2=21-I
 70 Y2=22-I
 80 FOR X=I TO Y2
 90 IF Y2-X<=1 THEN 120
100 POKE SM+I*22+X,160
:POKE CM+I*22+X,B
110 POKE SM+Y2*22+X,160
:POKE CM+Y2*22+X,B
120 POKE SM+X*22+I,160:
POKE CM+X*22+I,B
130 POKE SM+X*22+X2,160
:POKE CM+X*22+X2,B
140 NEXT X
150 GOTO 40
```

Making a Bouncing Ball

Our second exercise is a simple one for the JR-200 and TS1000: to produce a ball that bounces off the borders of the screen. At this point, we will deal only with the JR-200 and TS1000 since the method for doing this on the Vic is vastly different.

Let's start with just four main statements: one to give us a starting point for our plot of a bouncing ball, one to clear the screen, one to plot the ball, and one to repeat the plot.

JR-200

```
 10 X=2:Y=2
 50 CLS
160 PLOT X,Y
190 GOTO 160
```

TS1000:

```
 10 LET X=2
 15 LET Y=2
 50 CLS
160 PLOT X,Y
190 GOTO 160
```

This is definitely a long way from bouncing, so let's get the ball moving by adding the following lines. Remember, use SLOW mode on the TS1000 if you want to see the ball.

JR-200

```
 20 I=1:J=1
 90 X=X+I
100 Y=Y+J
190 GOTO 90
```

TS1000

```
 20 LET I=1
 25 LET J=1
 90 LET X=X+I
100 LET Y=Y+J
190 GOTO 90
```

As you can see, the same thing happened as with the border program, namely, the values exceeded the dimensions of the screen. To avoid this, we must add four IF statements to test for the screen edges. On the TS1000 version, we combined them into two statements to increase the speed a little. (As you know, SLOW mode really is SLOW!)

JR-200:

```
110 IF X>=62 THEN I=-I
120 IF X<=1 THEN I=-I
130 IF Y>=46 THEN J=-J
140 IF Y<=1 THEN J=-J
```

TS1000:

```
110 IF X>=62 OR X<=1 THEN
LET I=-I
130 IF Y>=42 OR Y<=1 THEN
LET J=-J
```

What happens when you RUN the program now? Try it and see. Just for kicks, on the JR-200 version add line 150 to change the color of the ball:

```
150 COLOR (INT(1+6*RND(0)))
```

While these programs produce interesting patterns, it is hardly a bouncing ball because the computer does not erase the previous ball position when it draws a new one. Add these lines to do that:

JR-200:

```
 70 COLOR 5
 80 PLOT X,Y
190 GOTO 70
```

TS1000

```
 80 UNPLOT X,Y
190 GOTO 70
```

Now the program works at it ought to, but you may wish to add a few more lines that give you the opportunity to choose whether the trail of the ball be erased or not. We also added a beep when the ball hits the edge of the screen on the JR-200. Here is the final program:

JR-200:

```
 10 X=2:Y=2
 20 I=1:J=1
 30 PRINT ''Leave trail
(y,n)''
 40 INPUT A$
```

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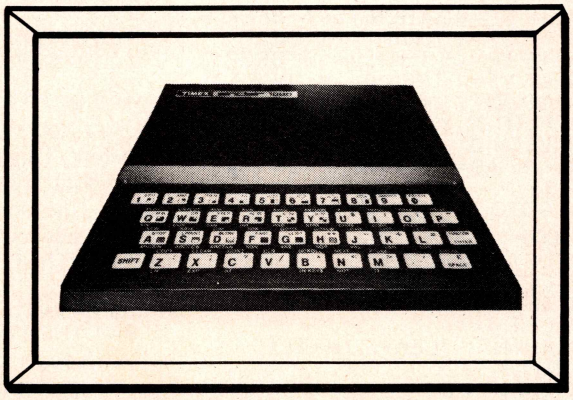

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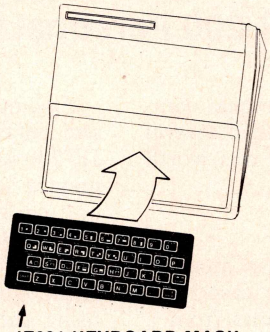

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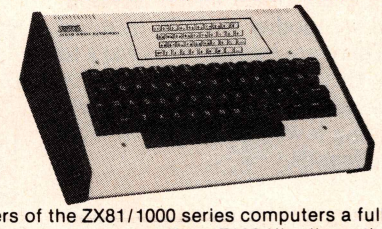

The JE682 Kit provides users of the ZX81/1000 series computers a full-size industrial keyboard hook-up to their computer. The JE682 Kit allows the use of either the full-size keyboard or the Sinclair/Timex Keyboard. The Kit also permits the simple disconnection of the Sinclair/Timex Keyboard for portable use. The JE682 Kit consists of a full-size industrial grade keyboard with 62 keys, 2 p.c. boards, 18" ribbon cable, DIP socket and 4 rubber feet. The keyboard conversion kit can easily be mounted into the DTE-AK enclosure. This enclosure is large enough to contain the ZX81/1000 computer and the full-size keyboard together. A handy label representing the ZX81/1000 keyboard layout is placed on the enclosure.

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CIRCLE 39 ON READER SERVICE CARD

```
 50 COLOR 0,0
 60 CLS
 70 COLOR 0,0
 80 PLOT X,Y
 90 X=X+I
100 Y=Y+J
110 IF X>=62 THEN I=-I:BEEP 1
120 IF X<=1 THEN I=-I:BEEP 1
130 IF Y>=46 THEN J=-J:BEEP 1
140 IF Y<=1 THEN J=-J: BEEP 1
150 COLOR (INT(1+6*RND(0)))
160 PLOT X,Y
170 BEEP 0
180 IF A$=''Y'' OR A$=''y''
THEN 90
190 GOTO 70
```

TS1000:

```
 10 LET X=2
 15 LET Y=2
 20 LET I=1
 25 LET J=1
 30 PRINT ''LEAVE TRAIL?
(Y,N)''
 40 INPUT A$
 50 CLS
 70 UNPLOT X,Y
 90 LET X=X+I
100 LET Y=Y+J
110 IF X>=62 OR X<=1 THEN I=-I
130 IF Y>=42 OR Y<=1 THEN J=-J
160 PLOT X,Y
180 IF A$=''Y'' THEN GOTO 90
190 GOTO 70
```

When a trail is left, the plot eventually fills in only every other screen location. How could we modify it to fill in every location? There are two or three ways to accomplish this, some of which produce more interesting effects than others. Hint: try doing it with a random variable or tricky rebounds.

Vic-20:

The Vic program for making a bouncing ball is altogether different from the TS1000 and JR-200 versions because we had to use POKE to produce the same effect. Let's start with a few statements to get a ball onto the screen and to make sure that it can be seen against the background. The control character in line 30 is the clear screen control character.

```
 30 PRINT ''#''
 40 X=7680
 60 CM=38400
 80 B=2
110 POKE X,81:POKE CM,B
```

That is, of course, a very long way from bouncing, so we can get the ball moving with the following lines. As in the border program, we must add the checking lines before you test the program, unless you enjoy subjecting your program to a possible crash. Also, be very certain that you type in the checking lines accurately; they are extremely important. When you are writing your own programs using POKE, you will find that the computer can and will crash. Then you will have to retype your program, if you did not SAVE it first. For experience, try changing the addresses of some of the POKE commands and see what happens. It is not a pretty sight.

```
 50 I=23
 90 CM=CM+I
100 X=X+I
120 IF X>8163 THEN I=I
-44
130 IF X<7702 THEN I=I
+44
140 IF (X-7680)/22=INT
((X-7680)/22) THEN I=I
+2
150 IF (X-7679)/22=INT
((X-7679)/22) THEN I=I
-2
190 GOTO 80
```

Now you can modify line 80 to what is below. This new line 80 gives the ball a random color. If the color chosen is white (the starting background of the Vic), a new color will be chosen. This is accomplished by the IF statement at the end:

```
 80 B=INT (7*RND(0)):IF
 B=1 THEN 80
```

Although this program produces pretty patterns, it is still not a true bouncing ball because the trail is not erased. Line 180 erases the trail by POKEing a space into the last position of the ball.

```
180 POKE X,32
```

Now the program is complete, but you may want more frills. The following program, in addition to bouncing a ball, gives you the option of erasing the trail or leaving it, and it adds a beep when the ball hits a side. Make sure you type this in exactly as shown.

```
  5 POKE 36874,249
 10 PRINT ''LEAVE TRAIL
(Y,N)''
 20 INPUT A$
 30 PRINT ''#''
 40 X=7680
 50 I=23
 60 CM=38400
 70 A=36878
 80 B=INT(7*RND(0)):IF
B=1 THEN 80
 90 CM=CM+I
100 X=X+I
110 POKE X,81:POKE CM,
B
120 IF X>8163 THEN I=I
-44:POKE A,15
130 IF X<7702 THEN I=I
+44:POKE A,15
140 IF (X-7680)/22=INT
((X-7680)/22) THEN I=I
+2: POKE A,15
150 IF (X-7679)/22=INT
((X-7679)/22) THEN I=I
-2:POKE A,15
160 POKE A,0
170 IF A$=''Y'' THEN 80
180 POKE X,32
190 GOTO 80
```

The Panasonic JR-200 Personal Computer

David H. Ahl

The Panasonic JR-200 personal computer from Matsushita has been several years in the making, and it was worth the wait.

Handsome Styling

Outwardly, the JR-200 has modern, pleasing styling. The plastic case measures 13.5″ × 8.0″ and slants from a height of 1″ in the front to 2″ in the rear. Finished in silver and matte black in the keyboard area, the case is rugged and durable.

Connectors and Switches

An 8-pin D.I.N. connector provides for an NTSC composite video or RGB monitor, while an RCA jack gives an RF signal on channel 3 or 4 at a 75-ohm impendence. On most current TV sets with a 75-ohm F-type input the JR-200 produces a crisp, clear image, almost of monitor quality.

Another RCA jack provides 8-ohm audio output to an external speaker. Audio power is more than adequate; people in the rear of a 100-seat conference room had no trouble hearing the internal speaker during a demonstration.

A second 8-pin D.I.N. connector is for the tape recorder. A DIP switch selects either 600 or 2400 bps. We were pleased to find that the JR-200 performed reliably at 2400 BPS on modest quality ($19-$29) recorders over a reasonable range of volume settings on standard tape.

Two other connectors are for a printer and an external bus. Via this bus, the JR-200 has a serial RS-232C port which may be set up for half or full duplex, 7- or 8-bit words, and odd, even, or no parity. JR-Basic does not use the standard format for RS-232C communications. Although data may be transmitted by using the OPEN-INPUT#/PRINT#-CLOSE statements a routine is needed to send or receive data on the end of the line.

User-Friendly Keyboard

The keyboard has 63 "Chiclet" style rubberized keys in standard typewriter layout, a 5″ spacebar, two double-width shift keys, and a double-height return key. The keys are ½″ square with standard keyboard spacing.

As on the TS1000, each key can make multiple inputs. The JR-200 has 253 built-in characters: 96 English letters, numbers, and symbols; 5 Greek letters; 63 graphics characters; 79 Katakana (Japanese) symbols; and 10 music and other symbols. All told, this is an exceptionally rich character set, right down to the inclusion of a happy face and stick figure man. All the symbols are formed within an 8 × 8 matrix as on the TS1000.

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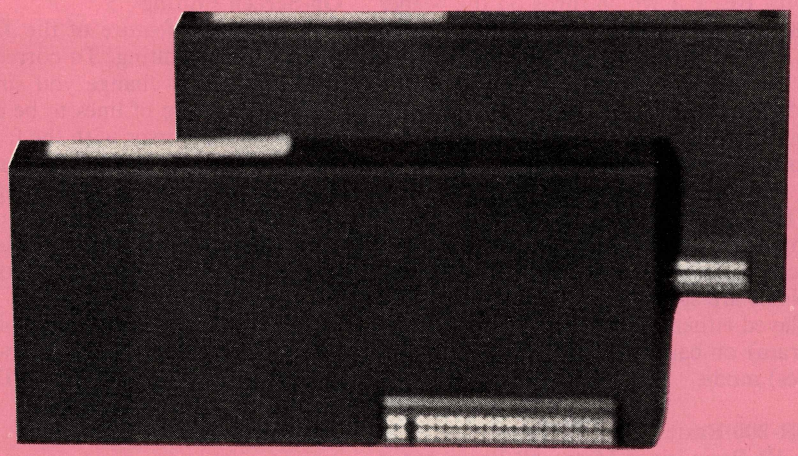

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Screen Display

Like the TS1000, the screen display is 32 × 24, and PLOT gives medium resolution of 64 × 48. However, very high resolution images, up to 256 × 192, are possible with LOCATE (x,y) which can address each of the 768 locations.

PLOT is also used with COLOR to select character color, background color, and display mode. Four display modes are available: normal, user-defined characters, inverse color of previous characters, and alter background color for positions following the cursor. When we got the hang of it, we found the COLOR command very powerful for producing interesting, and occasionally bizarre, effects.

Eight colors are available for foreground and background use: blue, red, magenta, green, cyan, yellow, white, and black.

Sound

While the JR-200 is theoretically capable of producing tones from 0 to 65535 Hz, realistically, the usable sound range is about five octaves, an impressive achievement in a computer of this size. The simplest way of producing sound is with BEEP 1 which turns on the beeper (880 Hz or A above the middle octave).

The next step up is SOUND (P,L) in which P is the pitch in Hertz (0 to 65535) and L is the length of the tone in milliseconds (0 to 255). This is very easy to use in a program.

More complicated are the PLAY and TEMPO commands which permit playing tunes with up to three parts over a 5-octave range at any imaginable tempo. Notes are stored in memory and may be played either in foreground (pauses program) or background (program continues) mode.

JR-200 Basic

JR-Basic is not Microsoft Basic, but it is not far away either. Most of the commands, statements, and functions are identical or very similar. Let's look at some of the more interesting and novel features.

JR-Basic has immediate mode and will execute most Basic commands directly from the keyboard singly or in groups (separated with a colon) as long as the maximum line length of 80 characters is not exceeded.

When the JR-200 is fired up, a copyright notice appears along with the number of free bytes. In all configurations, 2052 bytes are reserved for the Basic work area and the remaining RAM is available to the user. User memory can be expanded to 40K. Basic occupies 16K of ROM while video RAM, I/O, and the built-in character set use another 6K plus.

JR-Basic requires that Basic keywords be separated by at least one space or a colon or semi-colon from other characters. This enhances the readability of finished programs.

Numeric values can range from 2.9^{-39} to 1.06^{38} and are stored and displayed with nine digits of accuracy. Both numeric and string variable arrays can have one or two dimensions. Unfortunately, variable names are restricted to two letters or a letter and a number.

All the standard operators are available: arithmetic, relational, logical and string concatenation. LET is optional.

RUN performs its usual function but can also be imbedded within a program to run another program or to run the existing program from any specified line number, e.g., RUN 480. When used with a filename (RUN "Border"), it will load the program from tape and then run it.

The functions HOPS and VPOS return the current horizontal and vertical position of the cursor respectively. PEEK and POKE function as on the TS1000. An unusual function is VARPTR which returns the memory location where a particular variable is stored.

On-Screen Editing

A delightful feature of the JR-200 is full on-screen editing. To correct a mistake or make a change you simply list the line or group of lines to be changed, and move the cursor with the four directional keys to the character to be changed. Then type in the change or use the insert, delete, or rub out keys. You then move the cursor to the end of the line and type RETURN. Whoosh; the change is made.

FIND searches for a string of characters and then lists the line(s) with that combination of characters. LFIND performs the same function but lists the lines on the printer.

Tape Handling and Files

LOADing and SAVEing are done as on the TS1000, but there are some additional commands.

MSAVE and MLOAD permit files or other material to be saved and loaded directly from and to memory.

MERGE enables loading one program at the end of another.

VERIFY checks to see if a program in memory and on tape match.

PRINT # stores files of data (not programs) sequentially on tape, and INPUT # reads back the data. While sequential tape files are not nearly as handy as random access disk files, the 2400 bps I/O speed is quite tolerable.

Printed Output

The JR-200 has five printer commands: LPRINT and LLIST as on the TS1000; HCOPY which is the same as COPY on the TS1000; TAB which tabs over from the left margin; and SPC which spaces over from the last cursor position.

Joysticks

Two DB-9 sockets accept standard Atari-tyupe joysticks. Values form them can be read into programs by means of the STICK function.

Monitor Commands

The JR-200 allows machine language aficionados to get into the monitor and the assembly language.

The monitor has only three commands: D, M, and G. D displays 128 bytes of memory from the location from the address specified and allows you to alter them. G begins execution of an assembly language program from a specified address. Memory locations are all in hexadecimal.

Software and Support

Panasonic is sincere in trying to provide support for the JR-200. All the early machines have been put in the hands of software developers such as Datamost—a smart move for getting third party software on the market. Also Datamost has produced a version of their book, *Kids and the Apple*, for the JR-200. Likewise, we are in the process of producing a volume in our ideabook series for the JR-200, *The Panasonic JR-200 Ideabook*.

On the other hand, the preliminary JR-Basic manual is tough going, has very few programming examples, and could in no way be considered user-friendly. We are told that the Datamost book will be supplied with the JR-200 as the Basic programming primer.

In Summary

The Panasonic JR-200 is one of the nicest new computers to make the scene in some time. Attractively styled and easy to use, it boasts an excellent, if not standard, Basic language. The graphics are very approachable and, although resolution is not exceptionally high, the character set is excellent and allows the creation of detailed images. The keyboard is among the best of its type and the separate cursor movement keys make on-screen editing a joy. The JR-200 is cassette tape oriented and uses it well for program and data storage.

Peripherals, documentation, software and support are, at this time, question marks although Panasonic appears to be moving in the right direction on all fronts.

At the suggested list price of $350, the JR-200 is an excellent choice. ■

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letter from england

Stephen Adams

Dear Readers,

The number of computer shops selling small micros is growing daily as is the number of different computers available. But one advantage none of them except the ZX computers seems to have is SYNTAX checking (that annoying routine that tells you that you have made a mistake and that the computer will not accept the line) on entry. Also most of them have made economies along the way, so that user-friendliness goes out the window, so I still think you have to go a long way to beat a Sinclair!

By the way, did you know that a computer magazine which does comparisons between various computers month by month for the business man compared the ZX81 with the brand new, very expensive IBM Personal computer and found that on some arithmetic examples the 1K machine was faster than the 16 bit 128K IBM machine! *and* on another 16 bit 128K RAM machine only 1.6K was left for the user to program with after the machine had taken up its demands on the RAM for running the computer. This is about the same as the TS1000!

Software Developments

Software Libraries

A lot of argument has developed recently in England about a new set of companies called software libraries. They lend you tapes (after you have paid a small membership fee) of your favorite software for a period of a week or two to see if you want to buy it. If you do, then you get a discount on the purchase price of the tape. If, however, you want to try another tape, then you pay a small fee, varying from £0.50 to £1.50 to exchange the tape.

Software companies are, of course, not in favor of this system as it stops direct sales of tapes to the user. This is because the libraries can use the same tape over and over again. The libraries say that they ban copying by any of their members. However, it is becoming so easy to copy ZX81 and Spectrum tapes that they cannot guarantee it.

Some software companies have refused to deal with these libraries and have even started court proceedings over the matter. They say the hiring of tapes is prohibited by the copyright law and that the libraries are breaking it by encouraging copying of their tapes by making it so cheap. Since the cost of a blank tape is only £0.50, copying a tape costing over £3.50 for a friend becomes tempting and profitable. The question of whether copyright applies to computer program tapes has never been settled in court.

This, of course, worries not only the

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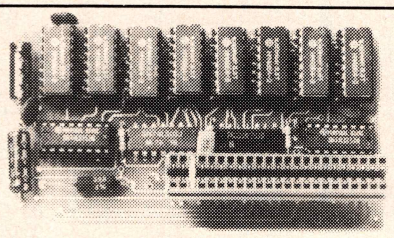

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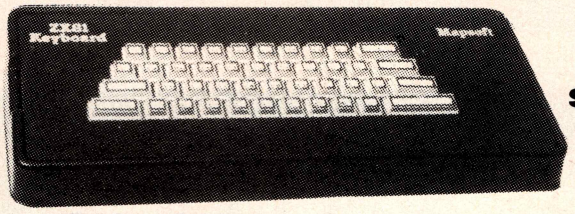

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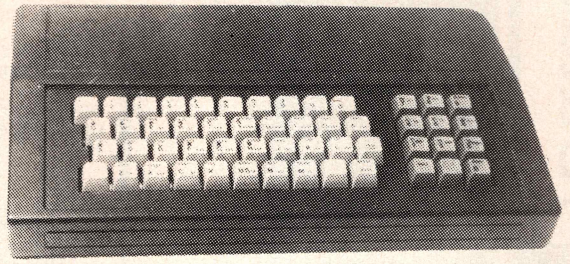

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Assemblers convert machine code written in mnemonics to the numbers the CPU will accept.

ZX software producers but also companies like Commodore (Vic-20/64 and Pet) and Atari.

However, the buy 'n' try scheme reduced its buy back period to one month which suited the software companies and the case never went to court. It would have been nice to see a precedent set as regards software piracy and copying. Both sides would have something to go on. The Law has a very grey area here.

Compilers and Assemblers

Another new market is the increase in software utilities such as Basic compilers for the Spectrum. These allow you to convert a very SLOW Basic program into a super fast machine code version. However, they do suffer from two problems: 1) the compilers cannot handle strings and floating point numbers (only integers), and 2) the final code contains what is called "RUN TIME routines" without which the code will not work. These "Run Time Routines" are copyright, the compiler writers claim; and, since they must be included in every machine code written by a compiler, they claim you must ask their permission (and pay them a fee) before selling that program. This sounds a bit daft as the compilers themselves use Sinclair's ROM routines (which are copyright), but they don't pay Sinclair a penny!

Another useful utility is an assembler. This converts a machine code written in mnemonics (a bit like Basic) into the numbers the microprocessor will accept. It also allows you to use variables called LABELs which specify a routine or area of memory to be sorted out later.

A very good assembler for the Spectrum is called ZEUS from Crystal Computing and is written in line numbers, just like Basic. It also has a full screen editor which allows you to use the cursor keys to delete or add text in any part of the screen. The text (or source file as it is known) can be printed on to the Sinclair printer or SAVEd and LOADed separately from the assembler. The assembler also allows you to locate the code anywhere in memory or to assemble it for running somewhere else (in case the area you want is being used by the assembler). A monitor is also included which allows you to view and alter memory with the same full screen editing. It also includes a hex to decimal and decimal to hex calculator. It makes writing machine code as easy as Basic as it reports any errors found in assembly or elsewhere. A disassembler is also available from Crystal to complement the assembler.

Imagine Software

Imagine Software has surprised the news here by paying programmer £35,000 a year to write games for them. Imagine is a breakaway group from Bugbyte who decided to go independent and is now into a multi-million pound turnover business. Their fame is based on the fact that all of their games are new ideas, not rehashes of arcade games. *Arcadia, Schzoids,* and *Wackey Waiters* are some of the best selling machine code games around and must be the craziest! *Wacky Waiters*, for instance, requires you to deliver food to the guests in the diner, dodging the boss and drunks, and not spilling the drinks on the way. Imagine also promotes the designers of the games by naming them on the software pack-

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Joysticks must now be programmable or have a conversion tape to fit the popular games.

aging. And what is so special about their programmer? He has only just left school and at 16 cannot apply for a credit card or a bank account to put his money in! A wide variety of software is now appearing for the Spectrum from astrology to music composition. The music composition program, for instance, allows you to write the tune on the stave (music bars) which appears on the screen in note form using very good graphics. Tunes can be stored and played back either as BEEPs or using an external 8910 sound chip which gives three notes, envelope, and noise. This program should run quite effectively on the TS2000 as it should have one of these chips built in.

Weekly Computer Magazines

At least one of the weekly (yes, I do mean weekly!) hobby microcomputing magazines has taken a stand. They will not accept any advertising from software libraries that do not have an agreement with software houses whose tapes they are using.

The number of weekly magazines for hobby computing has recently increased to three with the advent of *Home Computing Weekly* (from the Publishers of *Computing Today*) and *Personal Computer News* (from the publishers of *Personal Computing World*). *Popular Computing Weekly* had been launched in April 1982 by Sunshine Publications. Micros and their products are now moving so fast that it only takes a week for the whole situation to change. These are not trade papers as they contain reader letters, programs, and advice, all for £0.35 a week!

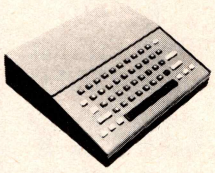
Hardware Developments

Joysticks

The main features of the hardware side seem to be that joysticks must now be programmable or have a conversion tape available to fit them into the most popular games. Some of the major companies have even been persuaded to write into their games a piece of software to use joysticks made by Kempston Microelectronics. AGF is one of the companies whose joystick has now been made programmable It takes an ordinary Atari type joystick and converts it to operate the same as pressing any key, so there is no conversion required in software for any new game.

Printer Interfaces

Printer interfaces for the Spectrum have also been making their presence felt in large numbers to complement some of the commerial software available. TASWORD, a very fast 61 character per line, stores its text on tape (Sinclair's microdrives still have not made an appearance). Originally it could print out only on the Sinclair printer, but Hilderbay and others have now produced an interface box with a centronics cable which will operate through TASWORD and its own driver software to print out on a full-sized printer. The graphics characters can be reprogrammed to give control characters such as underline, proportional text, enlarged and double height characters under user control. Also 132 or 80 characters per line make a great difference in formatting a page of text so that it looks a professional job.



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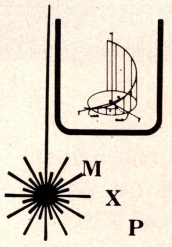

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Three Centronics printer interfaces have been produced for the Spectrum. Softest's interface is designed to work with the four color Tandy (Radio Shack) Pen Printer which can draw diagrams under software control. The other two are designed to allow you to use any parallel printer to LPRINT, LLIST and COPY from inside a Basic program. Both use Sinclair's own Basic commands to control the output to the printer, so no USR calls are required.

EuroElectronics interface box contains a ROM which changes LPRINT and LLIST commands to print on the centronics printer instead of the Sinclair's. LLIST, however, lists until it overflows on the printer which gives sloppy listings unlike what appears on the TV screen. It also cannot handle graphics or special characters like the underline symbol. To COPY the screen means LOADing a tape which puts a machine code program above RAMTOP and a modification to the GP100 type printers to remove the automatic carriage return facility. If this is not done, you get a blank line between each character line. The interface costs £53.48 and is so simple to use that all the instructions are written on the bottom of the interface box.

The second interface, from Kempston Electronics, requires a machine code program of 650 bytes above RAMTOP. A Basic program modifies the machine code to suit your printer and your program. Once this is done, the Basic program can be dispensed with and only the machine code LOADed when required. The Basic program allows you to select what characters will be printed instead of graphics, what type of printer you have (different printers require different codes for double width etc.), and, best of all, printer line length. You can specify a 32 column line length so that it prints out the listing just like on the TV screen. The use of a Basic routine for COPY, however, is a bit disappointing as it is so slow. This is the most user-friendly interface I have found so far, cost £49.

Modems

One of the electronics component companies has introduced a modem and RS232 interface for the ZX81 (and soon the Spectrum) to work 300 baud over the telephone line. The restrictions on modems over here are rather stricter than in the USA and hence the delay. PRESTEL is still one of the promised facilities available when we get the right modem.

Tape Copiers

Tape copiers seem to abound, and it would seem there is no way that a program on tape cannot be copied. Most of them work on the fact that the Spectrum allows you to copy any part of the memory to tape. So, if you can write a program which will load any program as machine code and then SAVE it again as an area of machine code, you end up with an exact copy, whatever the software companies try to do.

The best copier I have seen is called ZAP 2.0 which is produced by Scimitar Software. Copying is, of course, illegal, but sometimes it is necessary to make a back-up copy of your software in case the tape recorder screws the tape up.

Sinclair Developments

The Spectrum was launched in Europe (very quietly) in April 1983 although some people had been arranging to get some directly imported through friends. Each country though wants programs and devices written in its own language and so the importers must do the conversion as most of the software houses do not change their software from country to country. As long as this keeps up, the European user will be short of both software and hardware that is not home produced.

RAM upgrades for the Spectrum have been dropping in price, some are now as

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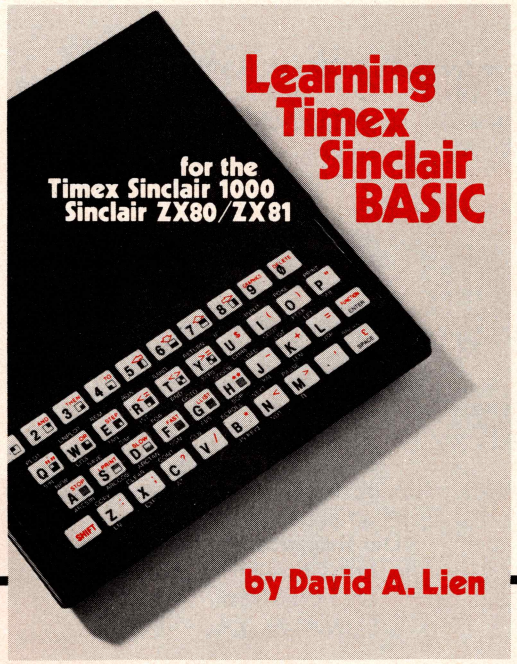

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low as £20 for the Model 2 machines. Sinclair has dropped the supply of RAM boards to Model 1 users due to the fact that he cannot compete with independent companies prices (the Model 1 needs a PCB instead of just the ICs as there are no sockets for RAM chips).

Sinclair has also dropped the microdrive for the moment, but has promised that the first 100,000 purchasers of the Spectrum will be given the first chance to buy them when they are available. He has also dropped the modem that was going to interface to the telephone line to pick up PRESTEL, a nation wide database run by Britain's telephone company.

This has disappointed the producers of a special service called Micro-Net 800 who have had to look elsewhere for modems for the Sinclairs. Other machines can already be connected up via an RS232 interface using an acoustic modem and some specially written software. The idea of Micro-Net was to sell or give away software over the phone lines as well as providing an information service simular to the Source in the USA. The service would cost approximately £100. This included the price of the modem and software to run it over the membership period of a year. At least 100 free programs were to be made available for each type of microcomputer and at night access to the Micro-Net would only be the cost of a local phone call.

Sinclair has reduced prices over here to £39.95 for the ZX81 and £99.95/£129.95 for the 16K/48K models of the Spectrum.

The companies I have mentioned are all in England and are listed below.

Kempston Microelectronics Ltd., 180A Bedford Rd., Kempston, Bedford MK42 8BL. Tele: 0234 852997.

AGF Hardware, 26 Van Gough Place, Bognor Regis, W. Sussex PO22 9BY. Tele: 0243 823337.

TASWORD, TASMAN software, 17 Hartley Crescent, Leeds LS6 2LL.

Hilderbay Ltd., 8-10 Parkway, Regents Park, London NW1. Tele: 01 485 1059.

Scimitar Software, 3 Palace Gates Road, London N22 4BW. Tele: 01 889 1099

Crystal Computing, 2 Ashton Way, Sunderland SR3 3RX.

Home Computing Weekly, ASP, 145 Charring Cross Road, London WC2 EE. Tele: 01-437-1002/7

Personal Computer News, Evelyn House, 62 Oxford Street, London W1A 2HG. Tele: 01-439-4242

Popular Computing Weekly, Hobhouse Court, 19 Whitcombe Street, London WC2 7HF. Tele: 01-839-6835.

Softest, 10 Richmond Lane, Romsey, Hants.

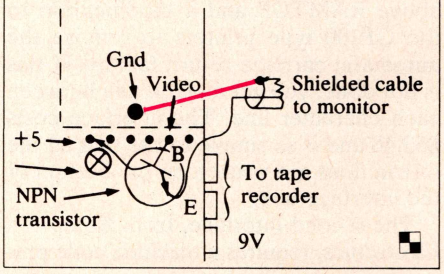
EuroElectronics, 29 Clarence Square, Cheltenham, Gloucester. Tele: 0242-582009.

Imagine Software, Masons Buildings, Exchange Street East, Liverpool L2 3PN.

Glitchoidz Report

Connecting a Monitor to the TS1000, 3:4.

The schematic should show a line from Gnd to the shielded cable as in the diagram below.



try this

"Try This" features short programs to show off your computer, impress your family and friends, and tickle your imagination when *SYNC* arrives at your place. Send your contributions to: Try This, SYNC, 39 E. Hanover Ave., Morris Plains, NJ 07950.

8K ROM; 1K RAM

Type in the following lines:

```
1 FAST
2 SLOW
3 FAST
4 POKE 16427,1
5 CONT
```

Press RUN and ENTER. Observe the results. Can you figure this one out? Our thanks to:

Michael Allen
48 Deerpath Rd.
Chalfont, PA 18914

8K ROM; any RAM

Type in the following lines:

```
10 FOR X=0 TO 31
20 LET R=INT (RND*5)+10
30 FOR Z=R TO 21
40 PRINT AT Z,X;"■"
50 NEXT Z
60 PRINT AT INT (RND*(17-R))+R
,X;"■"
70 FOR Q=5 TO R-1
80 PRINT AT Q,X;"■"
90 NEXT Q
100 NEXT X
```

Put the computer in SLOW mode for best results. Press RUN and ENTER. Observe the results. After you have digested the display, try the variation in the following lines:

```
10 FOR X=0 TO 31
20 LET R=INT (RND*8)+10
30 FOR Z=R TO 20
40 PRINT AT Z,X;"■"
50 NEXT Z
70 FOR Q=5 TO R-1
80 PRINT AT Q,X;"■"
90 NEXT Q
95 PRINT AT INT (RND*(R-7))+5,
X;"■"
100 NEXT X
```

Press RUN and ENTER. Which variation do you prefer? Our thanks to:

Tuan Ton
6837 Carnegie Dr.
Richmond, VA 23226

8K ROM; 1K RAM

Let's try Eric Chandler's "Try This" again (*SYNC* 3:4):

```
20 FOR N=1 TO 5
30 PRINT CHR$(38+INT(RND*26+
.5));
40 NEXT N
50 PRINT "###";
60 GOTO 20
```

Press RUN and ENTER; press CONT and ENTER for another screen. What happens here?

Line notes:

20: 5 letters

30: A random letter A-Z

50: 3 spaces after each word (8 * 4 = 32 = a full line).

Our thanks for the correction to:

Eric Chandler
1523 Club Terr.
Lynchburg, VA 24503

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CIRCLE 71 ON READER SERVICE CARD

resources

The "Resources" column lists new products for Timex/Sinclair users. Suppliers and users are invited to send brief product descriptions and details for ordering to: Resources, SYNC, 39 E. Hanover Ave., Morris Plains, NJ 07950.

Address Change
Biocal Software, Inc.
167 Wilson St.
Petaluma, CA 94952
(800) 237-8400, x70

Note: Biocal customers who bought tapes prior to April 1983 which would not LOAD can return the tape plus $1 for s&h for an updated tape with documentation.

Services

Repair Service/Maintenance Agreements

Renewable maintenance agreement keeps your system running. The only Sinclair Research Ltd. authorized service center in the nation. For further details, write to:

MicroSync Services
Box 2015
162 Marlboro St.
Keene, NH 03431

Programming Aids

Program Name Reader

Reads all names of programs on tape; prints to screen or to printer. Sees names one at a time as they are read from tape. Operates from REMark statement at 16514. Add $1 for customization to another location. 1K MC. Unusual bonus program included. Listing: $1 plus long SASE.

Multiple Programs in Memory. 2K RAM.

Store from 2 to 47 programs depending RAM. Allows programs to be swapped in a split second. Memory is divided into uniform sections; so programs must be roughly same size. Customized version that resides in 8K to 16K block: $1 extra. MC. Listing: $1 plus long SASE.

John Richard Coffey
PO Box 448
Scottsburg, IN 47170

BEST Computer Coach

Audio instruction tapes and computer program tape package. Presents audio-visual show for teaching the meaning and relationship of commonly used computer terms. For TS1000, but versions available for other computers. Write for information. $19.95.

Boston Electronic
Systems Training
1420 Providence Hwy.
Norwood, MA 02062

Engineering

Passive Solar Design Pack

Calculates heat loss, solar gain, solar fraction, storage mass. $87.85. SASE for list of programs.

Surveyors Travers Correction

Adjusts angles turned, bearings, error of closure, area of plot, for closed, loop travers. $52.85. SASE for list of programs.

MCS Software
2816 Edmond St.
St. Joseph, MO 64501

Aircraft Performance Program

Charts climb rate vs airspeed to make performance comparisons of aircraft under varying conditions of weight, power, and altitude. Booklet with listing, explanation of all equations, and a tabulation of specifications for 250 production and homebuilt aircraft: $7.95.

Robert Fingerle
PO Box 7793
Fremont, CA 94537-7793

Electronics/Radio

Electronics Engineer

Menu driven program for the electronics hobbyist or engineer; covers voltage division, LED voltage dropping, resistor color codes, and Ohm's Law. CC and instructions: $4 pp. (money order).

Steve Dinstbier
1159 W. Taft Rd.
St. Johns, MI 48879

Electronics Subroutines. Combo II. (FX1002)

Capacitive time constants; current power dissipation inductance; Ohms Law; Joules Law; parallel; series resistance; parallel; series capacitance; etc. $12.95; $1 s&h.

JPR Software
PO Box 4155
Winter Park, FL 32793

Morseman 3

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PO Box 151
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New York, NY 10044
(212) 980-1646, 308-4237

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Computer Navigation

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Lakeland, FL 33803
(813) 686-3311

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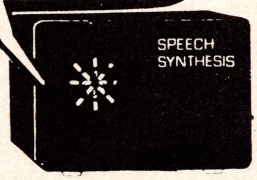

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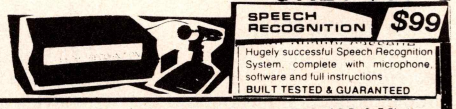

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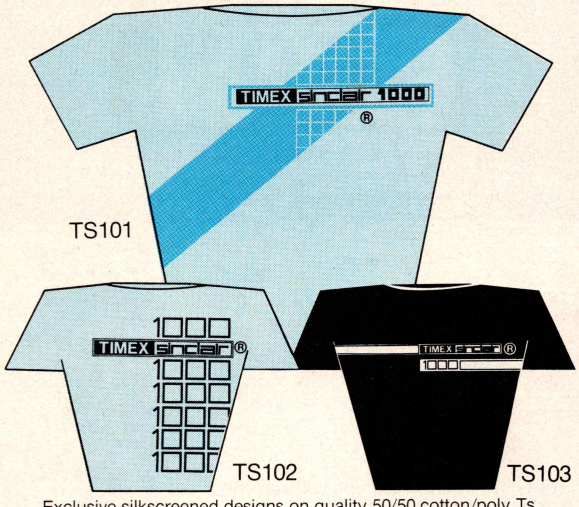

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TS1000 demonstration tape for retailers to increase sales or for anyone wanting to show off the computer. ZX81 version available. Specify. $10; $1 s&h.

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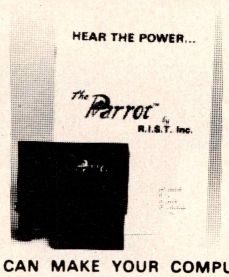

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W. D. Maples
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688 Moore St.
Lakewood, CO 80215

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Produces tones over wide range of frequencies. Attach earphone (not included) through tape recorder and get sound that can be heard several feet away. USR function and 2 to 4 POKEs specify frequency and duration. Bonus line drawing program included. Routine can be customized to location other than 16514 for an extra $1. MC. Listing: $1 plus long SASE.

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Complete program for designing/testing bass and subwoofer speaker cabinets. Includes simplified measurement procedures and 2 unique alignments for very small bass cabinets. CC: $8.95; $1.50 s&h.

Mallard Software
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You are trapped in your shack during an earthquake.

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You are the evil Mazor creating mazes that none can escape. One or two players. For more information write:

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Budd Lake, NJ 07828

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10 round game with maximum score of 5000 points. High score is saved by program (1 counter per difficulty level). 10 levels of difficulty Specify French or English version. MC. $14.95 Canadian.

Micro Da et Fils
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New twist on a familiar challenging game.

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Computer draws on over 500 words.

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Play the "cube" on your computer.
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Sheffield Lake, OH 44054

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Race around a 100 mile course. Decide when and how high to climb in various thermals for the highest course speed. 1K program uses text; 16K uses simulated instrument panel graphics. Includes a discussion of glider flight for the uninitiated. Listings: 1K: $4; 16K: $6.

Wordpuzzler

Hides words in a random character matrix. Search for them on screen or on printout. Put in your own words or use those stored with the program. CC: $7.95

Robert Finngerle
PO Box 7793
Fremont, CA 94537-7793

Domino (SQ-111)

28 dominos; play against the computer; each starts with 5. Object is to make opponent go to boneyard or pass. This earns points. $9.95; $1 s&h.

Yahtzee (SQ-101)

1 to 4 players. Roll 5 dice; improve roll by rolling any or all of the dice. Object: to score each improved hand on 13 line score sheet. Game is over when all the lines are used. $9.95; $1 s&h.

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Antropuss is a man eater living in a cave of 20 rooms each with 3 tunnels. You must move from room to room avoiding the antropuss and other hazards. You win by shooting the antropuss with one of your 5 arrows. $9.95; $1 s&h.

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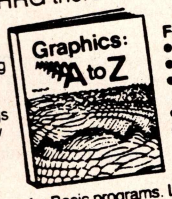

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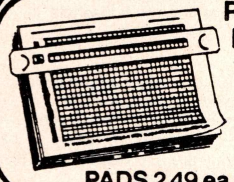

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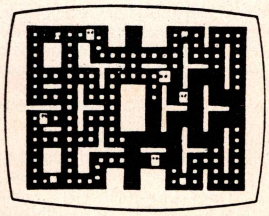

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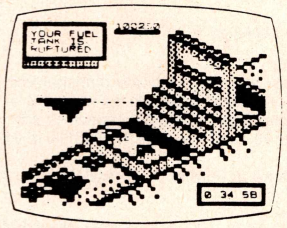

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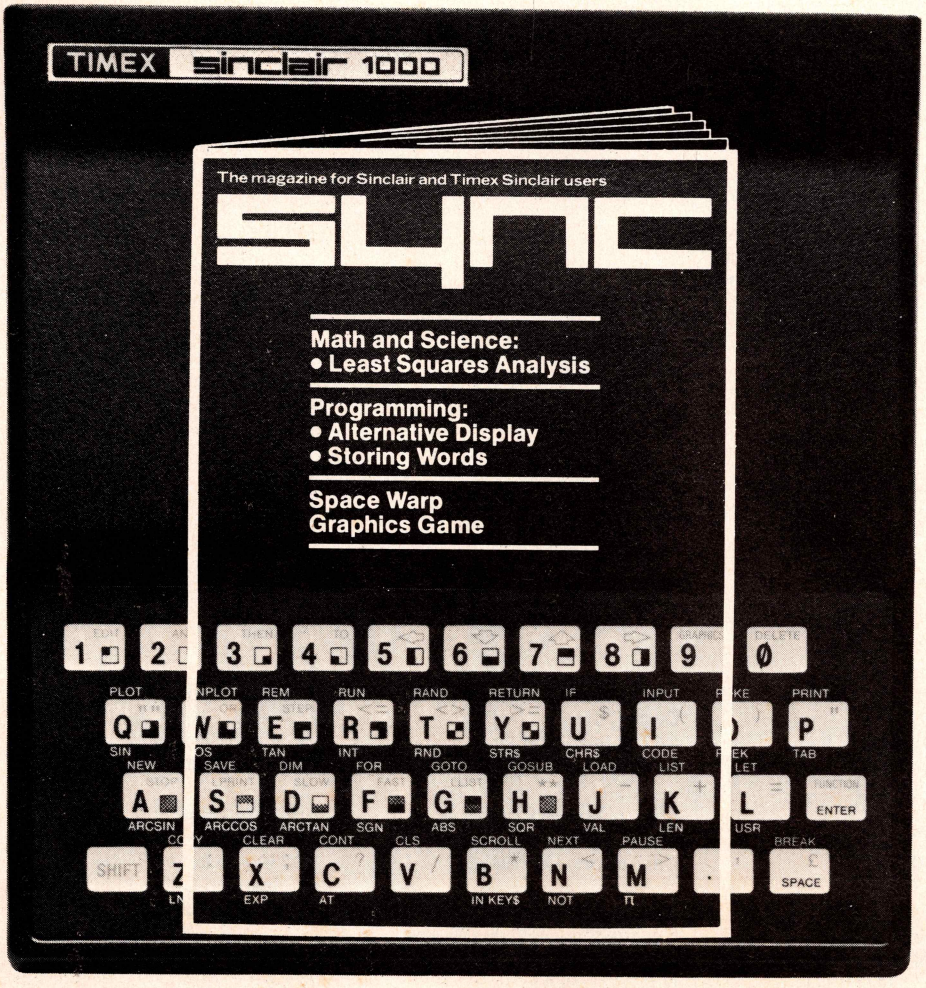

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The book titles may refer to the ZX81 or the TS1000, but the contents will apply to both machines. If you have an unexpanded ZX81, you may not be able to use some of the program in books developed specifically for the unexpanded TS1000 which take advantage of the 2K RAM on board. If you have a TS1000, you can use any of the books written for the unexpanded ZX81. If you have a RAM pack, you should have no problems either way.

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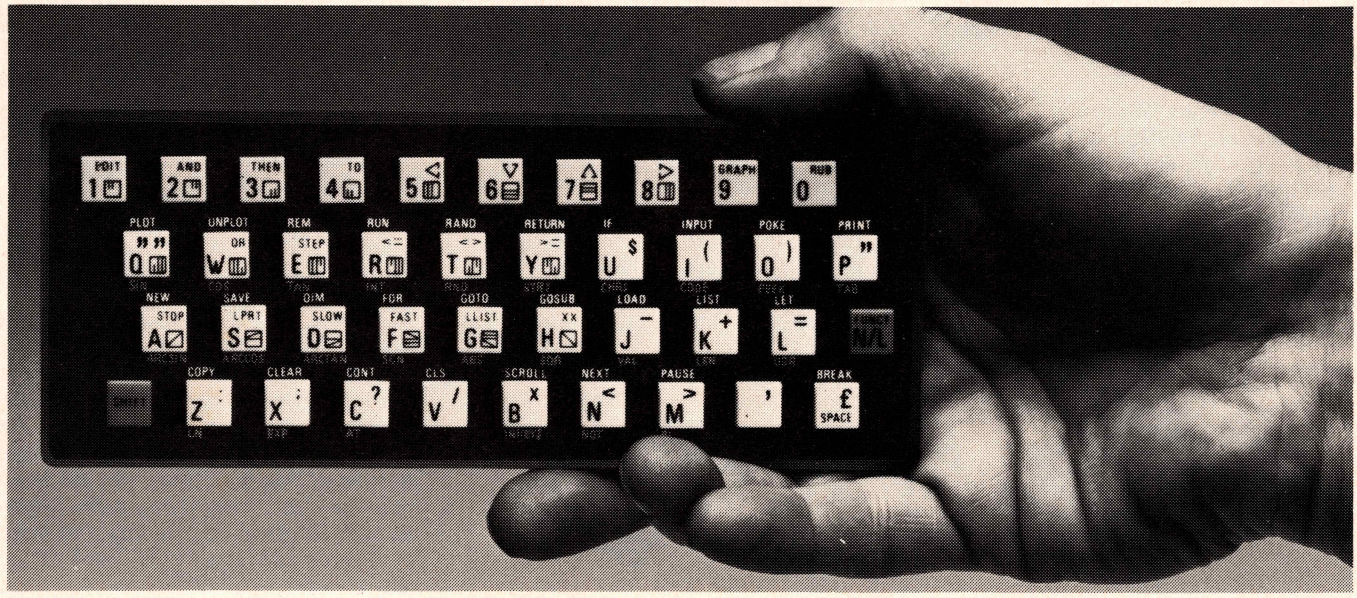

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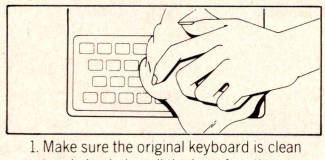
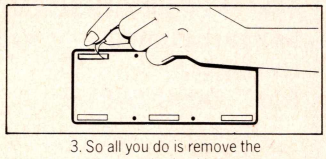
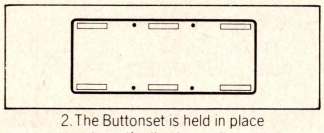


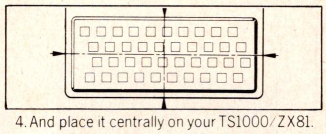
1. Make sure the original keyboard is clean and check that all the keys function.



3. So all you do is remove the protective backing.



2. The Buttonset is held in place by self-adhesive pads.



4. And place it centrally on your TS1000/ZX81.

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Please send me_____(qty.) Buttonset(s) at $19.50 each (inclusive of postage & packaging).

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Creative Computing Press
The Best of SYNC, Volume 1
Edited by Paul Grosjean. $9.95 plus $2 s&h.

A collection of over 80 of the most valuable articles, programs, tutorials, and reviews that appeared in Volume 1 (1981) of *SYNC* Magazine. A vital resource for users of the TS1000, ZX81, ZX80 with 8K ROM, ZX80, and MicroAce computers. Topics include: games, math applications, graphics techniques, programming tips and tutorials, translation from other Basics, machine language programming, hardware, reviews, glossary of computer terms.

Computers for Kids (Sinclair Edition)
By Sally Larsen. $4.95 plus $1 s&h.

Written specifically to introduce children 8-13 years old to the ZX81. Requires no previous knowledge of computers, algebra, or variables. Enables the child to program a ZX81 in less than an hour. Includes a section for parents and teachers. 56 pp.

Fifty Programs for the Timex Sinclair 1000
By Leland B. Carter. $6.95 plus $2 s&h.

This book features 50 program listings which the TS1000 users (beginners on up) can type into their computers directly and and run. listings include: games, puzzles, mathematical calculations, filing programs, graphics programs, calendar and more. No knowledge of Basic required.

The Gateway Guide to the ZX81 and ZX80
By Mark Charlton. $9.95 plus $2 s&h.

Practical programming manual for the beginner with the TS1000, ZX81, or ZX80. Furnishes over 70 fully documented programs. The majority have been written for easy conversion from machine to machine (ZX81 to ZX80 and vice versa). Describes each function and statement, illustrates it with a demonstration routine or program, combines it with previously discussed material. 172 pp.

Getting Acquainted with Your ZX81
By Tim Hartnell. $9.95 plus $2 s&h.

Contains more than 70 programs to help the reader get the most from his TS1000 or ZX81. Game programs include: Checkers, Alien Imploders, Blastermind, Moon Lander, Breakout, Star Burst, and Derby Day. Programs for cascading sine waves, plotting graphs and tables, data sorting, equation solving, plus the use of PLOT, SCROLL, PRINT, TAB, PEEk, POKE, and much more. 120 pp.

The Timex Sinclair 1000 Ideabook
By David H. Ahl. $6.95 plus $2 s&h.

50 ready-to-run educational programs demonstrate scores of different techniques for solving problems in mathematics, science, and business. 10 chapters deal with solving problems by formulas and repetitive trials, convergence, recursion, compounding, probability, geometry, science, simulations, and drill and practice. Some problems demonstrate the capabilities of the computer; others identify its shortcomings. 152 pp.

The ZX81 Companion
By Bob Maunder. $9.95 plus $2 s&h.

For both ZX81 and TS1000 users. Assists in four applications areas: graphics, information retrieval, education, and games. Contains scores of fully documented short routines plus complete programs. Disassembled listing of the ZX81 ROM monitor. 132 pp.

Katie and the Computer
By Fred D'Ignazio and Stan Gilliam
$8.95 plus $2 s&h.

Explains to a child how the computer works. Katie falls into the land of Cybernia inside her Daddy's computer. Her journey parallels the path of a simple command through the stages of processing. She encounters the multi-legged and mean Bug who lassos her plane and spins her into a terrifying loop. Supplementary information on computers, bytes, hardware, and software. For 4-10 year olds.

Be a Computer Literate
By Dr. Sylvia Charp and Marion Ball
$6.95 plus $2 s&h.

Uses tasks like mowing lawns, issuing paychecks, and controlling traffic lights to introduce basic computer concepts. A light-hearted informative text tells about the kinds of computers, what goes on inside the machine, the language of the computer, and how computers work for us. The problem of averaging class grades is used to show how to write a simple program. For grades 5-9.

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The Microcomputer's User's Book of Tape Recording
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Excellent book explaining how to set up your recorder to achieve reliable results. The book discusses problems that arise and explains how signals are recorded. Coupled with the Vu Meter and Test and Alignment Tape, many hours of frustration can be saved.

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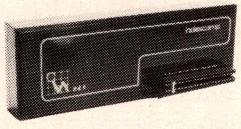

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BASICARE Microsystems — *A family of identical modular units which measure 7.3"x3.4"x.8". The units, which stack on top of one another to build a complete system, may be configured to the user's individual needs.*

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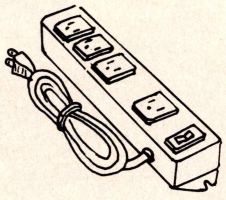

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HEAVY DUTY POWER SUPPLY — 9V with ON/Off switch. Much more powerful and cooler running than the standard power supply.....**$24.95**

PAGE SEGMENTS

0000	ROM	8K	Computer BASIC interpreter and operating system.
200	TOOL	(8K)	Machine coded routines or data storage.
4000	FILE A	(16K)	Normal residence of BASIC programs.
800	DATA	(8K)	Used for extra data space or storing long BASIC programs.
A001	PATH	(4K)	Not presently used.
B000	SLOT	(4K)	Used in conjunction with other peripherals.
C000	FILE B	(16K)	Used for display but can be used for BASIC if no display is used.

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FULL FUNCTION KEYBOARD

VERY POSITIVE FEEL AND SOUND

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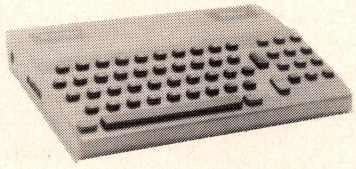

Single stroke keys: DELETE, STOP, EDIT and FUNCTION.

SHIFT keys are BLUE with blue legends for shifted operations. FUNCTION key is GREEN with green legends for function operations. DELETE, STOP and EDIT keys are RED. NUMERIC keys are BLUE. Other keys and legends are BLACK. Case is grey. Nothing to solder on, paste on, cut or drill. Only a screwdriver is needed to fit the computer inside the keyboard.

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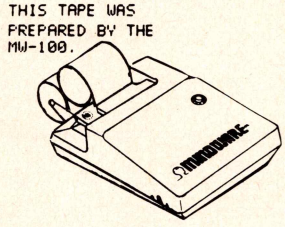

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30 Programs for the ZX81
By Richard Altwasser. $9.95.

From the Cambridge Collection are 30 programs for the TS1000 and the ZX81. These programs are written for the unexpanded 1K or 2K machine. Entertainment and learning from one of the designers of tomorrow's systems.

Dilithium Press
Control Things with Your Timex Sinclair. $6.95.

Put your TS1000 to work. With a few inexpensive parts, measure the outside world automatically—light, heat, weight, and more. Turn on lights remotely. Add audible alarms and other sounds to your computer's repertoire. Time events. Add a real keyboard and/or a joystick.

How to Use the Timex Sinclair. $3.95.

Authors assume you know nothing about computers in general or the TS1000 specifically. They tell you what to expect and how to handle the problems you will encounter. You learn how to set up the computer, how to make it work, where to buy accessories and software, and where to get additional information. Practical advice while steering away from technical tidbits.

More Real Time Applications for the TS1000/2000. $12.95; with software: $24.95.

Provides you with some ready to use programs and gives an insight into the techniques on which software is built. Full documentation and detailed commentary. Programs include: Dif, Till, Statistics, Cricket, Carbon Dating, Half Life, Reactions, Gas Laws, Doppler, Triangle, Peristalsis, Electrolysis, Spider Invaders, Notes, Music.

The Secrets of Using the Timex-Sinclair.
By Jerry Willis. $3.95.

Provides an introduction to the computer's basic components; an overview of the things you can do with it; step by step instructions on how to set it up; LOADing and SAVEing; introduction to Basic; information on how to select, buy, install, and use popular accessories; sources of information about your computer such as magazines, books, and users groups. 124 pp.

The Sinclair ZX81. $11.95; with software: $24.95.

Practical programs to do real jobs in a variety of environments. Includes: bulk storage, word processor, financial applications, banking uses. Author pushes the ZX81 and casts aside the idea that it is too small for any real computing work.

32 Basic Programs for the Timex Sinclair Computer. $19.95; with software $34.95.

Games, graphics, education applications and practical uses. Purpose of the program is described and how to use it is explained. Sample run and complete program with suggestions for changes. Main routines and variables listed.

Using and Programming the Timex Sinclair Computer. $9.95.

An introduction to programming the TS1000. Complete education in Basic along with neat tricks in Basic applications. Machine language introduced.

Wayne Green Books
Converting to Timex/Sinclair Basic: A Guide to Translating Basic Programs.
By Stuart L. Bird. $14.95.
ISBN 0-88006-063-8

Teaches readers how to translate Basic programs written for other Basics to run on the TS/ZX computers. Contains a description of each statement and an example of its use. Differences among state-

Extend your ZX81/TS1000: Add Memory that won't Forget!

- ADD YOUR OWN SYSTEM UTILITIES
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- UP TO 8K NONVOLATILE RAM
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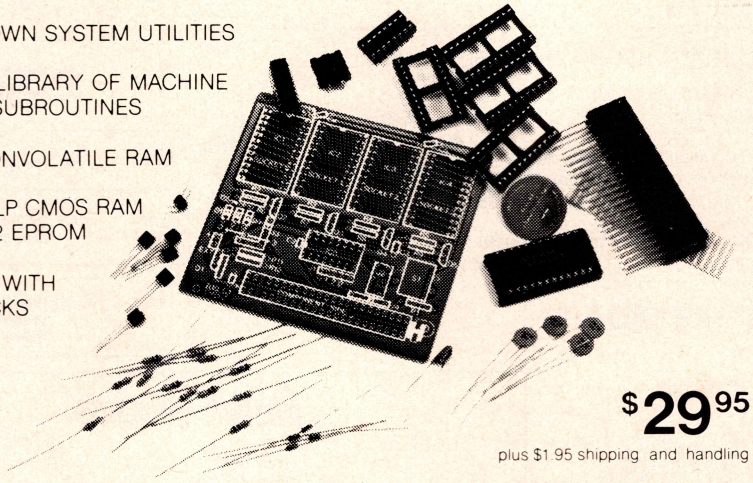
- COMPATIBLE WITH 16K RAM PACKS



$29.95
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▶ *READ THE REVIEWS:*

What a super product!...conceived and executed very nicely...and with quality components.
(SYNTAX QUARTERLY Winter 82)

8K Nonvolatile memory is a gem! It has so many possible uses...I recommend this board most heartily.
(OKLAHOMA S.U.G. Newsletter 1/3)

We found the documentation to be far superior to that (of) most hardware we've received.
(S.U.N. Newsletter Nov/Dec 82)

For versatility this is even better than an EPROM...ranks quite high on the list of "must-haves".
(SYNC Magazine Mar/Apr 83)

INTRODUCTION

This memory board is designed to fill the transparent 8K block of memory (from 8 to 16K) in a ZX81-16K system. This area of memory is an ideal place to store, either permanently or temporarily, machine language routines or data which are to be used by the BASIC system.

A sample display routine, a program—merging routine, and procedures for storing utilities on tape are included with the kit.

The use of HM6116LP 2K CMOS RAM memory IC's with their own reserve power supply means that routines stored in the RAM are nonvolatile — the RAM retains its memory even when the ZX81 is switched off or reset. Moreover, being RAM, the routines you store in the memory are easily modified. The lithium cell supplied with the board will maintain sufficient reserve power for almost ten years.

ASSEMBLY

Complete step-by-step instructions in a 20 page manual make assembly of the board easy. Construction takes between two and three hours. The kit (pictured above) is complete with a silkscreened solder-masked printed circuit board, all capacitors, resistors, transistors, sockets, connectors, integrated circuits, and the lithium cell. The board is supplied with one 2K CMOS 6116LP-3 RAM — it will accomodate three more for a total of 8K.

Complete kit with 2K	$29.95
Additional three 6116LP-3	$16.00
Bare pc board & manual	$13.05
Assembled & tested with 2K	$44.95
Assembled & tested with 8K	$59.95
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ments and various Basic dialects are covered. Over 130 Basic instructions (200 including synonyms) are discussed.

Using the Timex/Sinclair 1000.
By Ralph M. Coletti. Price: TBA.
ISBN O-88006-065-4

For those who have mastered the users manual and want to go on. Programming techniques include how to save memory, how to translate into TS/ZX Basic. Programs with home, business, educational, and scientific applications are provided with descriptions and suggestions on how to adapt them. Hardware modifications are also discussed.

J.L. Hartwell
Using Your Timex/Sinclair Microcomputer
By J. L. Hartwell. $6.95 plus $1 s&h.

Why not unleash the potential of your personal computer? This publication goes a step beyond the basic programming manual supplied with the computers. It is not meant as a substitute for the owner's manual, but contains information which clarifies and expands upon concepts introduced in the manual. Learn how to translate programs from standard Basic into the Sinclair dialect.

Jenn Products
Fifty Nifty Programs for Your ZX81
1K RAM. $9.95.

For the unexpanded ZX81. Written in Basic to facilitate learning; complete instructions. Packaged in an 8½ x 11 spiral bound format which lies flat for convenient referral, these programs feature a variety of graphics and are mostly of the game/activity nature with a few utilities.

Fifty Programs for the Timex Sinclair 1000
2K RAM. $9.95.

For the unexpanded TS1000, all 50 programs are in Basic with many user friendly statements to facilitate learning. Featuring plenty of graphics, the programs are mostly games/activities with a few utilities. All listings come complete with instructions and are packaged in an 8 ½ x 11 spiral bound book which lies flat for convenient referral.

Fred Johns
Trouble-shooting and Repairs for Your ZX81.
By Fred Johns. $4 plus $1.50 s&h.

Shows how to diagnose problems and make repairs; trouble shooting tips to shortcut diagnosis; diagrams of where to check. DC readings throughout the board. Some test programs. Where to buy parts. List of tools needed, especially a good volt/Ohm meter and LED tester. About 25 pp., 8 1/2 x 11.

K.D.V.H.E. Publishers
Sinclair ZX81/Timex Sinclair 1000 Statistics: Twelve 16K Programs Including Multifactor Analysis of Variance.
By A. H. Wolach and M. A. McHale. $11; cassettes: $15; individual programs: $1.50.

Twelve programs for statistical analysis using t-test and analysis of variance. Extensive directions for entering data; complete example of data input and output for each program; large data sets can be handled with 16K RAM. Tests include: independent groups t-test; correlated measures t-test; one, two, and three way analysis of variance and more. 200 pp.

McGraw-Hill Book Co.
Basics: A Guide to the Timex/Sinclair 1000.
By Henry Mullish. $9.95.

Introduction to programming that shows readers how powerful and flexible Basic is while working at their own pace. Applicable to the TS1500.

Bogglers: 22 Smart Games Programs (2K to 16K) in Timex/Sinclair Basic.
By Graham Charlton, Mark Harrison, and Dilwyn Jones. $12.95.

Entertainment and utility programs for any TS/ZX machine with 16K RAM. With more memory to work with the programs are more challenging. The programs are fully tested.

Crunchers: 21 Simple Games for the Timex Sinclair (2K).
By Henry Mullish and Yin Chiu. $8.95.

Fully explained game programs written expressly for the TS1000. Games of chance and skill written in Basic. Hours of family entertainment as well as informative introduction to programming. Applicable to the TS1500.

GOSUBS: 100 Program-Building Subroutines in Timex/Sinclair Basic.
By Edwin and Shirley Gaby. $9.95.

A library of programming subroutines, fully tested, immediately usable in larger programs. For TS1000, 1500, and 2000 series (with minor modifications described in the book).

Science and Engineering Programs for the Timex/Sinclair 1000.
By Cass Lewart. $13.95.

25 professional programs for the TS1000 with 2K RAM. Written for the engineer, scientist, or college student. Covers problems in electrical engineering, number theory, computer science, probability, statistics, and operations research. Programs solve, i.e., complicated queuing and reliability problems, find solutions to transcendental and differential equations, find best fitting Lagrange polynomials and work with complex numbers.

ZX81/TS1000 Programming for Young Programmers.
By Linda Hurley. $9.95.

Affords young people the satisfaction of getting hands on the machine immediately and of running programs from the very start. The book is in two colors and has color coded programs. Applicable to all Timex computers.

Melbourne House Software, Inc.
The Complete Sinclair ZX81 Basic Course (25895MY)
$34.50.

A comprehensive manual designed to teach you to write and develop Basic programs for the TS1000 and ZX81; no other books or aids are necessary. Easy step-by-step guide with programs and "test yourself" exercises throughout. Every concept and function is fully described by simple programs. Over 100 programs and examples. Reference work for experienced programmers. By Beam Software.

Basic Course Cassettes (26490MY)
Two cassette pack: $7.50.

Contains some of the major programs of the *Basic Course* manual above including games, puzzles, and programming hints and tips.

The Ins and Outs of the Timex TS1000 & ZX81
By Don Thomasson.

An invaluable source of information on the hardware aspects of the TS1000 and ZX81. Complete circuit diagram. Full discussion of the unorthodox methods used to put the components together and how they work. Projects to demonstrate the potential of the computer included.

Not Only 30 Programs (26025MY)
By Melbourne House. $9.95.

Gives *Not Only 30* fully debugged programs which will fit into the 1K RAM of the ZX81 (and also the TS1000), but also a detailed explanation of how to write your own exciting programs. Includes: Star Wars, Lunar Lander, Black Jack, and Adventures. Aimed at beginners.

Machine Language Programming Made Simple for Your Sinclair and Timex TS1000 (25957)
By Melbourne House. $14.95.

Go beyond Basic into machine language programming and open computer horizons you never thought possible. Learn how to use the computer's own language and find out about PEEK and POKE. Programming techniques, hints, and tips. Aimed at beginners. 120 pp.

The Complete Timex TS1000/Sinclair ZX81 ROM Disassembly (20922M)
By Dr. Ian Logan and Frank O'Hara. $19.95.

Examines all the routines in the ROM and comments on each. Part A covers addresses 0000h to 0F54h which include all the functions except for the floating point calculator. Part B covers all the routines involved in the "evaluation of an expression" and a detailed explanation of the "floating point calculator." For the experienced programmer.

Understanding Your ZX81 ROM
(25913MY)
By Dr. Ian Logan. $14.95.

Illustrates all the facilities of the ZX81/TS1000 monitor, how it works, and how you can use it in your own programs. A section on machine language use and subroutines will add to your programming power. For advanced beginners to experienced.

Micro Design Concepts
Timex Sinclair Sourcebook. 96 pp. $6.95 plus $1.25 s&h ($2.50 s&h for outside U.S.).

BEST KEYBOARD AVAILABLE!

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- Measures 10¾"×7¼"×2⅛"

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SAMWOO provides a much better picture for your Sinclair Computer than your TV monitor. Simple modification procedure includes easy-to-follow instructions.

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- 6.6" wide, 3.2" high, 1.08" deep

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Listing of applications, software, addon hardware, books, catalogs, and magazines. Listing includes author, program description, types of media available, minimum equipment configuration, price and ordering information. Listings by category from worldwide sources. Over 600 listings from over 160 suppliers.

Oxford Computer Publishing Ltd.
Machine Code Test Tool ZX81 & Timex 1000
16K RAM. Cassette: $19.95.

The ultimate tutor and debug program. Lists and displays machine code instructions as they are written. Ideal for both the novice and the expert.

Prentice-Hall, Inc.
Programming Your Timex/Sinclair 1000.
By Michael & Simon Barnett. $12.95.

Shows families how to utilize the TS1000 in the home. Everything from doing homework to household management.

Programming Your Timex/Sinclair 1000 in Basic.
By Mario Eisenbacher. $9.95 (paper); $17.95 (cloth).

Introduction to Basic programming for those with no previous computer experience. Easy to digest format leads the user through hands-on examples of programs in the early chapters and helps develop skills gradually for more complex programs.

Programs for Your Timex/Sinclair 1000.
By Melbourne House Publishers. $9.95 (paper); $15.95 (cloth).

Fully explained programs, scores of programming hints and space saving techniques, and PEEK and POKE explanations. 30 varied programs including Blackjack, Checkers, Battleship, Craps, Simon, Breakout, Mini adventure, Roulette, Starwars.

30 Games for the Timex/Sinclair Computer.
By William Behrendt. $4.95.

30 games ranging from fortune telling programs to simulation of the ecosystem. Fun and engaging.

Timex/Sinclair Interfacing: Tested Projects for the ZX80, ZX81, and the Timex/Sinclair 1000.
By James Downey. $10.95.

How to construct interfaces with instructions for building a relay controller, a joystick interface, analog to digital conversion and more.

Que Corporation
Timex/Sinclair 1000 User's Guide. Vol. 1
By Joseph C. Giarratano. $12.95. $9.95.

A practical guide for learning to pro-

gram. Introduction to computers, how to use it as a simple calculator, then as a super calculator, then as a computer to run programs. Learn how to use prerecorded programs and how to write your own through chapters on Basic programming, utility commands, input, tests and decisions, loops. 228 pp.

Redditch Electronics
Programming For Real Applications
16K RAM. £6.95 plus s&h.

Includes programs for personal finance, word processor, bulk storage, money, banking, educational, hardware improvements. Cassette tape also available (£11.44).

Reston Publishing Co.
Basics of Timex Sinclair 1000, ZX81 Basic.
By Allen H. Wolach. $10.95.

Covers hierarchy of arithmetic operations; entering programs; branching; arrays; loops; multidimensional arrays; simulating library functions; using subroutines; SLOW and FAST mode; relational operators in logical decisions; plotting; graphics in strings; plotting; slicing; strings in arrays.

The Explorer's Guide to the ZX81 and Timex Sinclair 1000
By Mike Lord. $12.95.

The classic "advanced" book for the TS1000 and ZX81, now available in the U.S. and Canada. New features of Basic; new machine code programming tips and elements of the ROM; 30 games and other programs: application routines; hardware tips; how to add a fullstroke keyboard; and more.

Fifty 1K/2K Games for the ZX81 and Timex Sinclair 1000
By Alastair Gourlay, James Walsh, and Paul Holmes. $10.95.

A new selection of games designed for the TS1000 and ZX81; all in 1-2K. Features such arcade favorites as: Dogfight, Breakout, Outlaw, Galaxian, Roadracer, Alien Invasion, and dozens more.

Self-Teaching Software for the ZX81 and Timex/Sinclair 1000
16K RAM. $29.95 each.

Children from grades 1-6 will find basic arithmetic skill instruction and numerous practice programs. Each package contains 2 cassettes with 32 lessons, games and activities, and an explanatory booklet. A classroom aid. Packaged in a durable vinyl binder. Six units each sold separately. By Joseph R. Gladstone.

Making the Most of Your ZX81
By Tim Hartnell. $10.95.

This handbook focuses on the additional features of the TS1000 and ZX81. New games and useful learning tricks help show how to write programs that really work! It will guide users from start to finish, through each feature and function of the TS1000/ZX81 personal computer.

Mastering Machine Code on Your ZX81.
By Toni Baker. $12.95.

Using this guide, the reader learns the ins and outs of ZX machine code translation. The handbook reveals the secrets of the ZX81 and shows how to adapt the ZX81 code to the ZX80 machine.

49 Explosive Games for the ZX81
Edited by Tim Hartnell. $10.95.

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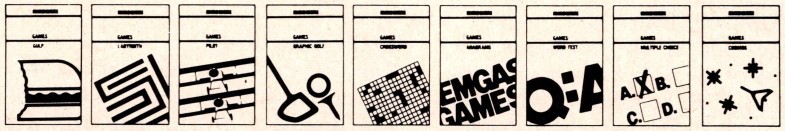

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The ZX81 Pocket Book
By Trevor Toms. $10.95

Helps readers create their own programs and understand why they work. It shows what the ZX81 or TS1000 can do, and how "extras" can help it do more. Reveals new applications for ZX81 Basic; offers simplified data file storage and retrieval techniques and more.

Softest
M Code, Basic Booklets $20.

Rapid Reference Series 8 page booklets on machine code and Basic. Instruction set is collated and set out for ease of access. Similar to a comprehensive set of prompt cards.

Sybex
More Uses for Your Timex Sinclair 1000: Astronomy on Your Computer
By Eric Burgess. $6.95.

Look at the stars in your own personal planetarium with programs that allow you to observe the apparent movement of the stars, planets, and meteor showers. Written in Basic and ready to be entered on your TS1000. 176 pp.

Your Timex Sinclair 1000 and ZX81
By Douglas Hergert. $6.95.
176 pp. ISBN: 0-89588-099-7.

Discusses the setup, operation, and capabilities of the computer; how to connect it to a TV; benefits of additional attachments; how to program for a variety of tasks, e.g., doing calculations, making bar graphs, drawing pictures on the screen, playing games.

Timex Sinclair 1000 Basic Programs in Minutes
By Stanley R. Trost. $6.95.

Collection of useful programs to take full advantage of each of the TS1000 function capabilities. Calculate home finances, analyze business and personal investments, investigate real estate options, analyze data, keep records. Ready-to-run programs. No knowledge of Basic is required. Just ENTER the programs and you are ready to compute.

The Timex Sinclair 1000 Basic Handbook
By Douglas Hergert. $4.95.

Describes and provides examples of each word in the TS1000 Basic vocabulary. Every keyword and function is explained carefully and thoroughly. Short example programs illustrate the use of each command in its syntactically correct form. Special notes provide insight to subtleties and extra features of each Basic word. 170 pp.

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By Douglas Hergert. $6.95.

Answers your questions about the set up, operation, and capabilities of your computer: how to connect it to your TV set, the benefits of additional attachments, how to program it for a variety of tasks such as doing calculations, making bar graphs, drawing pictures, playing games.

Tab Books Inc.
A Kid's Manual for Programming the Sinclair/Timex Computers. $6.95 (paper) (FPT $7.25); $12.95 (hard).

Written by an elementary school teacher with experience in classroom use of computers. Makes programming exciting for any age group. A fun alternative to plug-in games that helps to prepare today's kids for the computer dominated environment they will face.

Using & Programming the ZX81/TS1000, including Ready to Run Programs. $7.95 (paper) (FPT $8.25); $14.95 (hard).

Everything the beginner needs to learn and how to put it to work in a variety of applications. Introduction to the essential concepts of hardware and software, the unique characteristics of the TS/ZX machines and a mini-course in Basic programming.

TSG Enterprises
The Watchmakers Guidebook to the Timex Sinclair Computers. $4.95 pp.

A directory of suppliers with a brief description of their wares including about 250 software, 100 hardware, 30 ancillary. Directories of user groups, Timex/Sinclair specific magazines, newsletters, directories, books, and articles in other magazines, An introductory chapter about writing a program in Basic.

V and H Computer Services
What can I do with 1K?
By Roger Valentine. £4.95.

40 programs and routines for the unexpanded ZX81 or TS1000. United Kingdom publication; also published in US by John Wiley Inc.)

What can I do with 16K?
By Roger Valentine. £4.95.

11 fully documented programs for the 16K RAM ZX81 or TS1000. United Kingdom publication; also published in US by John Wiley Inc.

What Can I do with My Timex Sinclair 1000? Lots!
By Roger Valentine
$9.95; $19.95 w/cassette.

56 programs for the TS1000, incl. 35 that run on 1 or 2K, presented with clear descriptions that teach programming principles by example. Includes sophisticated games, file programs, graphics, personal finance. Also available on optional cassette.

John Wiley & Sons
Byteing Deeper into your Timex Sinclair 1000
By Mark Harrison. $12.95.

A step-by-step guide to the capabilities and limitations of the TS1000/ZX81. Teaches TS1000 Basic programming, and includes 37 programs of increasing complexity as examples. Programs for games, math, graphs & graphics.

Timex Sinclair 1000 Basic: Quick Reference Guide
By Held. $2.95.

A reference card to the TS1000 keyboard, commands, functions, statements, symbols, and messages, designed to be kept right with the computer for instant access.

TS2000/Spectrum Books

The books in this section apply to the TS2000 series. We have listed only those supplied by U.S. publishers here. See Eric Deeson's "The Bookshelf Goes Supernova" elsewhere in this issue for a collection of publishers and titles in the U.K.

Birkhauser Boston, Inc.
Introducing the Timex/Sinclair 2000: Programs, Games, and Graphics.
by Ian Stewart and Robin Jones.

Look for it in fall 1983.

Microscene
Guide to ZX Spectrum Resources
Edited by Eric Deeson. $6.50 (incl airmail)

Resource collection includes listings of: Spectrum suppliers, books, magazines, user groups, extra memory, add-ons, software, and other supplies. Software section categorized and products are rated in 8 areas on a 6 point scale. 92 pp.

Prentice-Hall, Inc.
Introducing Timex/Sinclair 2000 Machine Code.
By Ian Sinclair. $12.95.

Enables users to achieve high speed graphics and advanced game applications on the TS2000. Available in Sept.

Programming the Timex/Sinclair 2000.
By S. M. Gee. $19.95.

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4. **MICRO-ORGAN**— 4 octave organ music through your TV
5. **KALEIDOSCREEN**— TV screen becomes a computerized kaleidoscope
6. **ADDITION DRILLS**— 4 skill levels and scoreboard
7. **SUBTRACTION DRILLS**— 4 skill levels and scoreboard
8. **MULTIPLICATION DRILLS**— 4 skill levels and scoreboard
9. **DIVISION DRILLS**— 4 skill levels and scoreboard
10. **COMPUTER AIDED INSTRUCTION**— General purpose education program
11. **STATISTICS**— Computes mean, variance and standard deviation
12. **LINEAR REGRESSION**— Computes regression coefficients and displays equation
13. **VECTOR MATH**— Adds two vectors and provides resultant vector
14. **SIMULTANEOUS EQUATION SOLVER**— Solves system of simultaneous equations
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programming techniques to sophisticated graphics and sound capabilities. Includes many listings and game applications.

The Timex/Sinclair 2000 and How to Get the Most from It.
By Ian Sinclair. $9.95.

Introduces the TS color computer, covers machine set up and operation, plus Basic programming.

The ZX Spectrum: Your Personal Computer.
By Ian McLean. $12.95.

An introduction to the TS2000 and Spectrum, explaining the fundamentals of Basic programming.

General Books

The computer section of any bookstore these days contains an overwhelming selection of material. We have gathered a few titles we have come across which might be of general interest.

CompuSoft Publishing, Inc.
The Basic Handbook: An Encyclopedia of the Basic Computer Language. 2nd ed.
By David A. Lien. $19.95.
ISBN 0:932760-05-8

An encyclopedia of nearly 500 Basic words. Covers the dialects used by over 250 computers manufactured world-wide. Features special sections on Disk Basic, TRS-80 Extended Color Basic, Atari Basic, Tektronix Basic, and converting programs from one computer to another. Listed alphabetically with test programs, sample runs, variations in usage, and alternate spellings. 480 pp., 7 x 9. Paperback.

Computer and Electronic Supply Services
Computer Guide 1983.
Ed. by S. I. Barrett and L. A. Sweeney. $37.25.

Guide to over 250 small and personal computers from over 100 computer companies in 5 sections: application programs and system software; programming languages; machine characteristics; consumer information; stores and vendors. Comparison charts. New editions annually; quarterly updates. Over 1500 pp.

Dell Publishing Co.
The Official Computer Hater's Handbook.
By D. J. Arneson. $3.95.

Everything the computer hater needs to know about: how to destroy a computer; what to do with a dead computer; how to tell if your teenager is using computers; how to understand computerspeak; how to turn off computer conversations at cocktail parties; and more. 192 pp.

Wayne Green Books
Inside Your Computer.
By I. R. Sinclair. $12.97.

Explains microprocessor chips, hardware circuits, the interpreter, the use of machine language; hardware, software, computer components, the microprocessor, the accumulator, and operating systems. Sections on compilers, assemblers, monitors, binary numbers, analyzing a Basic line, and using Basic and machine code in combination.

Para Publishing
Word Processors & Processing.
By Dan Poynter. $11.95 pp.

Discusses what word processing is and how it can help the reader; the parts, functions, and features of the word processor; how to buy one and how much; sources of additional information; glossary of word processing terms. 172 pp.

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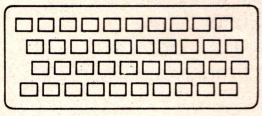

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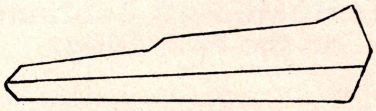

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Comprehensive software buyer's guide listing over 21,000 software packages from over 2900 software publishers and 200 microcomputer manufacturers. Cross referenced to hardware, operating systems, application packages, programming languages, and prices. 840 pp.

Prentice-Hall, Inc.
The Computer Cookbook: How to Create Small Computer Systems That Work for You.
By William Bates. $12.95 (paper); $21.95 (cloth).

Comprehensive reference guide on putting together microcomputer systems from various component; explains the ingredients that must be integrated into finished systems; offers specific, factual, timely information including an industry listing.

St. Martin's Press
The Complete Handbook of Personal Computer Communications: Everything You Need to Know to Go Online with the World.
By Alfred Glossbrenner. $14.95.

Shows how to send electonic letters, telexes; to buy modems and communications software; using the Source, CompuServe DJN/R; troubleshooting; electronic banking; online fact finding; shopping online; free computer bulletin boards; free software; encyclopedic data bases. 325 pp.

Sybex, Inc.
Programming the Z80. 3rd ed.
By Rodney Zaks. $16.95.
ISBN 0-89588-069-5

Covers all aspects of programming the Z80 in assembly language. Includes systematic descriptions of Z80 hardware organization, complete instruction set, Z80 addressing modes, data structures. Application examples and exercises. 624 pp.

Z80 Applications.
By James W. Coffron. $14.95.

Learn the necessary programming and interfacing techniques to connect the Z80 microprocessor to common microcomputer parts; basic and advanced I/O techniques; diagrams; examples. 288 pp.

Yes! Bookshop
Computers: A Comprehensive Guide.
By Chris Popenoe. $2.00.

A comprehensive guide to computer books. 819 titles listed and classified: computer fundamentals; computer and society; microcomputers (by machine); languages (by type); assembly languages and microprocessors; operating systems. Authors index. 60 pp. 8 1/2 x 11.

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The Bookshelf Goes Supernova

Eric Deeson

Maybe old-stagers among the *SYNC* readership will recognize the allusion in my title. It refers to a piece of mine published here in the March/April 1982 issue. Called "The Exploding Bookshelf," the feature listed some 40 books on the ZX81 available in Britain at the end of the machine's first year of existence.

Now, a year and a half after that piece, I must tell you I have lost count of ZX81 titles. I would not be at all surprised if the length of the list has doubled by now—there is no doubt that the ZX81 is here to stay. Well, for a few years yet.

However, I am now to survey another shelf in the bookcase, that containing the books on ZX81's younger sibling, the Spectrum. It is now somewhat more than a year since that machine first appeared and, again, the number of books on it is of the order of forty. Before looking at these publications in any detail, I would like to make a few observations.

Observations

1) The books are bulkier now. Many in the ZX81 list had below a hundred pages; hardly any of the Spectrum books are so small.

2) The books are more professional now. Sir Clive Sinclair has created more than a trio of micros, and around them have grown hundreds of companies, many of which are frighteningly well-off. Sinclair converted some tiny publishing houses into comparative giants and caused the actual creation of others whose sales go into hundreds of thousands. The new wave of books are glossy, illustrated with photos and clear listings, and properly proof-read. Yet the price-range has hardly changed, being still £2.50 to £10 ($4.00 to $16.00).

The Spectrum books are bulkier, more professional, glossy with photos and clear listings, and proofread, yet cost no more.

3) Existing publishers have made little impact yet on this market. Their main problem is that they are used to years between commissioning and issuing. The new companies can get a manuscript into the bookshops in weeks. Maybe the big publishers will have to save face with a potentially successful drive into software.

The List of Books

In this survey I shall follow the pattern of "The Exploding Bookshelf." First comes a list, in publisher order, of all the books I know of. My brief comments follow the book listing; if there are none, it is because I have not seen the book.

Two extra details appear in the list this time. First is the UK price, where known. This is given because I used up *SYNC*'s fee last time in replying to your queries about prices. Some books are available in North America, and you will have to research that.

However, you can order direct from Britain. I trust no publishers will complain if you send them payments worked out like this. To the quoted price add £1.50 for airmail postage, etc. (£2.00 if the book costs more than £5.50). Remit that amount as a sterling cheque; if you wish to pay in dollars add another £1 before converting because British banks charge outrageously for dealing in dollars!

In case of doubt about prices and shipping costs, contact the publisher directly. Or you can contact a major distributor if you want several books. I recommend these two:

Software Bookshop, 30 Lincoln Road, Solihull, West Midlands, UK.

Mine of Information, 1 Francis Ave., St Albans, Hertfordshire, UK.

The second extra data item in the preliminary book listing is a code for type of book. I have identified five classes:

B: Beginner's introduction; attempts to put the (excellent) Manual into more suitable terms for novices.

P: Program collection; material which does not do more than give superficial notes on listings.

I: Intermediate coverage; more in depth work for those with some knowledge of Sinclair programming; may get into machine code somewhat.

A: Advanced work; for people who have mastered Spectrum Basic (which is not much different from TS1000 Basic).

M: Miscellaneous.

Following the broad shallow listing comes a list of half a dozen books with a paragraph or two discussion that I would recommend as being particularly good values. That is a personal recommendation, but, well, I *do* reckon to have made a deep study of Sinclair resources in practice. Even so, there may well be omissions, so I would best apologise now to any aggrieved publishers wondering why they have been left out.

Eric Deeson, 4 Ethel Rd., Harbonne, Birmingham B17 OEL.

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Understanding Your Spectrum by Ian Logan is a treasure trove of hints and tips and useful routines and details a dozen Spectrum bugs.

The Bird's Eye View

Addison-Wesley, 53 Bedford Square, London WC1.

M: *Logo Challenge,* Govier and Neave, 25 pp. £29.95 (incl. workbook and 2 cassettes). A superb package for home and school use on turtle graphics; good, but cramped, pupil work book; excellent teacher is guide; and two nicely packed cassettes. Important.

Altwasser, 22 Foxhollow, Bar Hill, Cambridge 3.

P: *Cambridge Colour Collection,* Altwasser, 64 pp. £6.95 (cassette available). The first book on the Spectrum. Fair enough: Altwasser designed the Spectrum. 20 good Basic programs with instructions but no notes.

Armada, Westerhill Road, Bishopbriggs, Glasgow 64.

B: *First Steps with Your Spectrum,* Hughes, 128 pp. (due July). Very well illustrated introduction for children.

AVC, PO Box 415, Birmingham 17.

P: *Learning with the Spectrum,* Deeson, 24 pp. £1.50 (cassette available). The second book(let) on the machine; 10 programs for school and home learning objectives; instructions and programming notes.

Collins Educational, 5 Buckingham Place, London SW1

M: *Spectrum Starter Pack 1,* McBride, 77 pp. £9.95 (including cassette). An integral cassette/workbook in fine style introducing Spectrum programming.

M: *Spectrum Starter Pack 2,* McBride, 112 pp. £9.95 (including cassette). Second half of the above.

Duckworth, 43 Gloucester Crescent, London NW1.

I: *Spectrum Graphics,* Hampshire, 192 pp. £6.95. A hasty non-technical collection of graphics programming tips and listings.

P: *Spectrum Programmes,* sic, (Hampshire).

Gower, Croft Road, Aldershot, Hampshire.

B: *Learning to Use the ZX Spectrum,* Bradbeer, 76 pp. £4.95. An amazingly superficial introduction from a usually brilliant writer, who indeed co-authored the Spectrum manual.

Granada, Frogmore, St Albans, Hertfordshire.

B: *The ZX Spectrum,* Sinclair (no-relation), 130 pp. £5.95. Sometimes superb, sometimes too speedy; overall good.

P: *The Spectrum Book of Games,* James, £6.95.

B: *The Spectrum Programmer,* James, £6.95.

Hewson, 60a St Mary's St., Wallingford, Oxfordshire.

P: *20 Best Programs for the Spectrum,* Hewson, 118 pp. £5.95. A well-varied collection, generally of high standard, with often excellent notes. See below.

A: *40 Best Machine Code Routines for the Spectrum,* Hardman and Hewson, 144 pp. £5.95. Nicely laid out and fully explained; this is not a collection of routines but a good grounding text with good examples.

Interface, 44 Earls Court Road, London W8.

B: *Programming Your ZX Spectrum,* Hartnell and Jones, 231 pp. £6.95. Another of the first few before the flood; half written by Tim Hartnell, once the most prolific Sinclair writer (*Interface* was set up by him); a very thorough book.

P: *60 Games and Applications for the Spectrum,* Harwood, 90 pp. £4.95. All kinds of program here, generally short (which is good); supplied with instructions.

Linsac, 68 Barker Road, Middlesborough, Cleveland.

I: *The Spectrum Games Companion,* Maunder, £5.95. Not seen, but, if it follows the pattern of Maunder's earlier serious ZX books, this will be good value.

Macmillan, Basingstoke, Hampshire.

A: *Advanced Graphics with the Spectrum,* Angell and Jones, 254 pp. £9.95 (cassette available). An absolutely marvellous book for really serious programmers. See below.

Melbourne House, Glebe Cottage, Station Road, Cheddington, Leighton Buzzard, Bedfordshire.

P: *Over the Spectrum,* various, 164 pp. £6.95 (cassettes available). 300 lengthy programs in good variety; detailed notes; plenty of illustrations.

A: *Understanding Your Spectrum,* Logan, 192 pp. £7.95. Tough going but super. See below.

A: *Spectrum Machine Language for the Absolute Beginner,* Tang, 245 pp. £6.95. Very thorough but rather dry.

M: *The Complete Spectrum ROM Disassembly,* Logan and O'Hara, 236 pp. £9.95. For the real specialsist a true goldmine; a superb volume is this.

M: *Spectrum Hardware Manual,* Dickens, 108 pp. £5.95. How the thing actually works; some nice tweaking ideas; very thorough.

Microscene, Battenhall Road, Harborne, Birmingham.

M: *Guide to ZX Spectrum Resources,* Deeson, 92 pp. £2.00. Details of over 200 suppliers to this market and their products; illustrations; reviews. I think it is invaluable, but I would, wouldn't I?

Phipps, 99 East Street, Epsom, Surrey.

I: *The Spectrum Pocket-book,* Toms, 160 pp. £5.50 (cassette available). Useful programs, lots of tips, and nice introductions to topics like machine coding. See below.

Prentice-Hall, 66 Wood Lane End, Hemel, Hempstead, Hertfordshire.

B: *The ZX Spectrum—Your Personal Computer,* McLean et al., 220 pp. £5.95. Rather too slow-moving, or very careful—depends on your speed I guess!

Shiva, 4 Church Lane, Nantwich, Cheshire.

B: *Easy Programming for the Spectrum,* Stewart and Jones, 139 pp. £5.95 (cassette available). Far and away the best introduction to Spectrum programming. See below.

P: *Computer Puzzles for Spectrum,* Stewart and Jones, 60 pp., £2.50. A wide variety of old and new teasers; good instruction; very well illustrated.

P: *Games to Play on Your Spectrum,* Wren-Hilton, £1.95. A very pleasant little book; just right for the transition between purchased games and your own.

I: *Further Programming for the Spectrum,* Stewart and Jones, 162 pp., £5.95. Another brilliant book from Stwart and Jones which I would deal with in depth below except I already have two of their magic spell-binders in that section.

I: *Spectrum Machine Code,* Stewart and Jones, 103 pp., £5.95. Anyone else's treatment of this topic would be coded A. Say no more? Well, I do say more! See below.

M: *Spectrum in Education,* Deeson, 176 pp., £6.50. So far the only coverage of Spectrum usage in a specific applications area; this looks at many kinds of applications in classroom and home learning situations; 50 programs, too. If I were not so scared of the author I would put "see below" now, but I wouldn't dare do that.

Sigma Technical, 5 Alton Rd., Wilmslow, Cheshire.

B: *The Sinclair Spectrum in Focus,* Harrison, 190 pp., £6.25. A thorough and thoroughly nice introduction that verges on I category in range of content.

Sinclair-Browne (*the* Sinclair), 10 Archway Close, London N19.

I: *The ZX Spectrum Explored,* Hartnell, 218 pp., £5.95. A unique attempt at providing a serious overview of the Spec-

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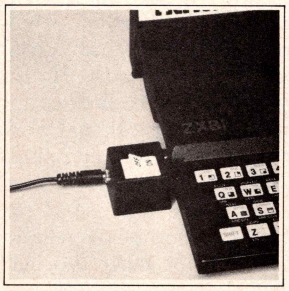

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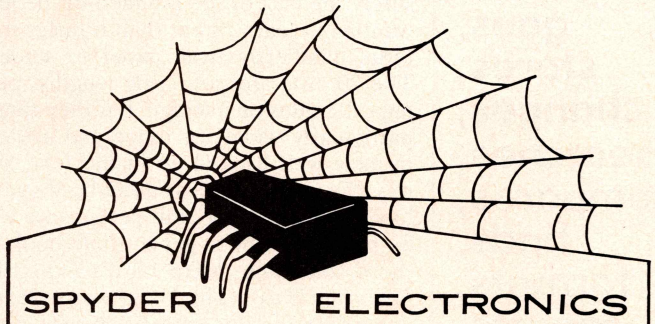

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CIRCLE 75 ON READER SERVICE CARD

The best introduction for beginners to computing is *Easy programming for the ZX Spectrum.*

trum and its uses; a mishmash of programming material, games, and text (illustrated with more listings, on business and education. A mishmash, true, but actually a well-knitted and readable one.

Sunshine Books, 19 Whitcomb St., London WC2.

I: The Working Spectrum, Lawrence, 216 pp., £5.95. Subtitled "A library of practical subroutines and programs"; this is not. It does contain lots of modules, some quite useful, broken carefully out of 19 lengthy programs (in many fields), but you cannot trace them.

Timedata, 16 Hemmells Laindon, Basildon, Essex.

I: *Exploring Spectrum Basic,* Lord). Lots and lots of great little listings with many new tips and effects; useful appendices, too.

The Worm's Eye View

Now I will turn to a more detailed consideration of the books I view as the best half dozen! Of course, those by that Deeson chappie are really the best but I shan't mention them again! Can't afford accusations, after all.

It seems sensible to begin at the novice end and narrow in to the more specialised staff.

I have absolutely no doubt that the best introduction for beginners to computing is *Easy Programming for the ZX Spectrum* by Ian Stewart and Robin Jones (Shiva). Ian is a world-renowned expert in catastrophe theory, an abstruse branch of math, but I am sure his bank manager is more delighted at his ability to turn out brilliantly readable programming books with Robin.

This one, accessible to youngsters and enjoyable by adults, is written in a gloriously user-friendly style with lots of good illustrations (even cartoons, another product of the Stewart brain) and gently developed program listings.

The book covers Basic throughly despite its fairly short length and uncramped style, going from square one to graphics, sound and PEEK/POKE. It is no bind to work through at any speed, and, when you reach the end, you will know a lot about programming (concepts as well as techniques) and have some super programs on tape.

As I said above, Tim Hartnell, author with Dilwyn Jones of *Programming your ZX Spectrum* (Interface), was right up front in the early Sinclair years. He started magazines and a great user group and wrote and wrote and wrote. He is pretty well retired now. This book does not show any of the haste of his original works and attempts to be definitive and comprehensible as well as "all things to all men" (and women). There are millions of program listings, but they do not overshadow the text, which remains fairly thorough and well-graded.

Once one has gone through an introduction to Spectrum Basic it is natural to turn to collections of rather more ambitious—and lengthy—listings. Thus one can learn more and build up a reasonable software library. The dangers with collections are two-fold: (a) inadequate proof-reading, and (b) inadequate commentary.

Andrew Hewson's *20 Best Programs* (Hewson Consultants) suffers from neither fault. Andrew, too, has been well-respected in the British Sinclair field for a long time, and that respect arises from his detailed knowledge and thoughtfulness. Both attributes are apparent in this book, surely the best of the P bunch for people wanting to learn rather than transfer material mindlessly from paper to screen. The 20 programs are fairly lengthy, perhaps 2-3 sides on average, but they range particularly widely in usage and are extremely well backed up in the text. We miss the way Andrew's earlier books gave lots of little tips, too, but perhaps we will be lucky enough to get a whole book of those sometime. Mike Lord's *Exploring Spectrum Basic* (Timedata) was a strong contender for this spot because it does contain tips, but it lost out in being comparatively disjointed.

Trevor Toms is yet another name you might know. His books have always been beautifully presented (even if a bit pedantic, and *The Spectrum Pocket-book* (Phipps Associates) is no exception. It does contain lots of hints (including the invaluable PAUSE 4E4 from ZX81 days that the Spectrum replaces with PAUSE 0!). However, Trevor's book mainly consists of programs, all fully annotated and material on programming philosophy. He goes a fair way into machine coding, too, but for the best introduction to that we must return to Ian Stewart and Robin Jones for their *Spectrum Machine Code* (Shiva). This is identical in style, approach, and outstanding value to their *Easy Programming*. It is not a heavy text on binary/hex/Z80 this and that; nor is it

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CIRCLE 63 ON READER SERVICE CARD

a dreary collection of ill-connected routines. It is a guide in the real sense of the word, in which the authors take you charmingly by the hand and lead you through machine code thickets in such a way that you do not notice that they are thickets at all. Even 10-year olds can compete in the arcade stakes with this book!

Among the advanced specialist works, we come first to *Understanding Your Spectrum* by Ian Logan. Ian seems to have dedicated his life to messing around, Tron-style, inside Sinclair chips. Subtitled "Basic and machine coding programming," this particular book is more accessible than some of the others. It is a treasure trove of hints and tips and useful routines and details a dozen Spectrum bugs, some of which of course have now been splatted.

The Basic material is a minority in Logan's book; he provides a summary of the keywords and their uses, briefly but always with novel points for consideration. The bulk of the volume is not deep machine code, but a bright and definitive look at ROM routines you can use in Basic programs and such like. The pages still look rather formidable at first sight, but closer examination will trap you into a great deal of midnight oil.

Advanced Graphics with the Spectrum by Ian Angell and Brian Jones (Macmillan) (yet another Ian; yet another Jones) is a quite marvellous book, after the publication of which no one can ever again say that the Spectrum is a toy! To be able to work through it you need good Basic, thorough math (Grade 12, say), and much patience. That is because this field is not a toy one, and the authors do not leave much out even if they write always in a user-friendly way.

"Good aft—!"

The book is well illustrated, as it needs to be in view of its content, and most adequately proof-read. The program material consists of many sub-routines (well-defined modules, which link together to produce the various systems required). In this way the authors take us from character graphics to orthographic projection with hidden line removal. The only area they do not touch is machine-code graphics, but that would be too much to ask for.

The ZX81 is alive and well in its homeland and the number of books on it grows steadily. All the same, after well over a year of the excitement of the Spectrum (an incredibly popular machine), publishing on that is where the action is. My main list is not complete, remember—there has probably been a book a week on the Spectrum since early last summer.

Bookshelf explosions are a real possibility—I now have more computer books on the floor than on the wall rather than risk having the wall come down! Far over a hundred Sinclair-based books do not help at all. ■

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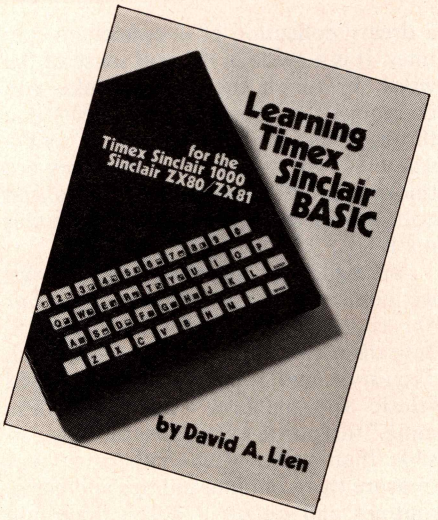
Book Review



Learning Timex Sinclair Basic

Sharon Zardetto Aker

Learning Timex Sinclair Basic by David A. Lien. Compusoft Publishing. $14.95.

If you have ever thrown down your TS1000 User Manual in despair—or disgust, help has finally arrived: David Lien's *Learning Timex Sinclair Basic.* It is a clear, thorough guide to programming the Timex Sinclair 1000, but ZX81 and ZX80 users are not ignored. No matter how "learner friendly" the manual for the new TS1500 will be, it could not be friendlier than this.

Lien takes the reader from plugging in the computer and doing a first PRINT command to writing search and sort routines and using PEEK and POKE. A sample program illustrates every new concept, and many of them are revised in the light of new materials presented—a very effective explanatory method.

Computer novices are always assured that a strong math background is not necessary for programming. Regardless of its necessity, a thorough grasp of mathematical principles is certainly desirable. Lien has given the best no-frills explanations of logarithms, exponents, and the trigonometric functions that I have seen. If you learn about arrays from this book, you will wonder why the array is considered so difficult by some.

The string functions are covered over several chapters; various concepts are introduced so slyly—I mean, slowly—that the reader can easily follow the development of an alphabetical sorting routine.

The chapters on video display graphics develop a simple shoot 'em-down arcade game that will give you a basic understanding and a new respect for the programming that goes into the real thing.

All the fundamentals of Sinclair Basic are covered in what the author notes is a "light and non-threatening" style—so light, in fact, that he occasionally gets carried away, leaving one wishing for something more substantive, e.g., regarding the screech on the tape: "You expected maybe Lawrence Welk?" or, regarding the rate/time/distance formula: "If it's been a few years, you might want to sit on the end of a log and contemplate that for a while." The misplaced cuteness is easily forgiven, considering the contents of the text and its otherwise excellent presentation.

The author notes that this book is based on the best of his earlier writings. This accounts for its quality and also its most serious flaw—serious in terms of the magnitude of the error, not in terms of the overall presentation. The chapter on "Debugging Programs" has not been thoroughly revised to suit the ZX/TS computers. He lists some common errors to check for if your program is not running correctly. Included here are a half-dozen mistakes that the ZX/TS syntax checker never lets you enter to begin with, and it will even show you where the error is when you attempt to enter the line, e.g., forgotten end quotation marks in a PRINT statement, using an out-of-range line number.

There are exercises sprinkled liberally throughout the book, with sample answers given at the end. Information is presented in small doses, in logical sequence, and in a light manner. You may find yourself wishing for a little more information in a particular area, such as how to PLOT a circle, other PEEK and POKE routines, or more moving graphics methods.

However, it was not Lien's intention to teach everything about some things, but something about everything, and he manages to do just that. It is hard to imagine anyone working through this book page by page and not acquiring a thorough understanding of ZX/TS programming techniques. It seems an ideal how-to book for teenagers as well as adults. ■

Sharon Zardetto Aker, 20 Courtland Dr., Sussex, NJ 07461.

Book Review

Mastering Machine Code on Your ZX81

Bruce T. Garrick

Mastering Machine Code on Your ZX81 by Toni Baker. Reston Publishing Company. 180 pp. paperback; $12.95.

Though written for the ZX81, Mastering Machine Code on Your ZX81 applies equally well to the Timex Sinclair 1000. Each chapter also includes addressing and programming procedures for the ZX80. The light conversational style is both entertaining and understandable.

The topics covered include: machine code loader programs, hexadecimal numbers, assembler mnemonics and commands. PEEKing and POKEing, MC storage, the stack, pushing, popping, negative hexadecimal numbers, subroutines in MC programs, the ROM and its many useful routines, music, the display file, some MC games, ROM disassembly, and the use of the ROM arithmetic subroutines.

Many annotated machine code routines illustrate the book. Since the Basic equivalents of the assembler commands are given, you can relate what you are learning to what you already know. Each chapter from four on concludes with exercises which are very important. If you do not do them, you will miss out on a great deal. However, the very first exercise could have been easier. Chapter 9 is worth the price of the book and more. It has a machine code program that allows you to List, Write, Insert, Delete, and Save your MC programs.

The appendices are excellent and include: the old and new ROM system variables with their addresses in hexadecimal and decimal, conversion tables for assembler to hex and hex to assembler, the ZX character set, and another complete listing of the machine code editing program.

If you may find the use of hexadecimal throughout the book inconvenient or cumbersome to use, you can use a converter program to shift to decimal when you do your own programming.

Mastering Machine Code on Your ZX81 is an understandable and entertaining guide that can take you, as it did me, from total ignorance of machine code to a fair comprehension, provided you are interested in learning machine code and willing to invest the time. It took about a month of my spare time to work my way through the book although that month was not entirely frustration free. While I am not quite a master of machine code, I can now write machine code to suit my purposes. And, though my programs may lack the elegance of greater experience, they really work. ■

Bruce T. Garrick, 6235 S. Yorktown Pl., Tulsa, OK 74136.

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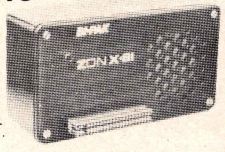

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Book Review

Sinclair ZX81 Timex Sinclair 1000 Statistics

Lawrence A. Kelly

Sinclair ZX81/Timex Sinclair 1000 Statistics: Twelve 16K Programs Including Multifactor Analysis of Variance by A. H. Wolach and M. A. McHale. K.D.V.-H.E. Publishers. $11.00. 6 program tapes, $15; individual program on tape, $1.50.

In the highly variable world in which we live, we use statistics to help us decide whether the small sample of the universe we look at is really representative of the entire universe. In most cases we want to know whether this sample is representative of a process which is better or worse than the rest of the universe.

Some people, highly critical of statistics, say that you can prove anything you want with statistics. Unfortunately, with the misuse of statistics this can be true. People who can be fooled by statistical abuses often confuse mathematical proof with statistical inference. Mathematical proof does not exist outside the theoretical world of mathematics. In the real world we must use more devious reasoning powers. In using statistics we must always be aware of how that reasoning works. Statistics "sneaks in the back door."

For example, we can never prove that one mouse trap is better than the other by statistics, but we can prove, with 95 percent or so assuredness, that the two mouse traps cannot be equivalent. The default of this circuitous logic is that the trap that catches more mice must be better since we are sure that the differences between mice caught by each trap could be observed by chance alone less than 5 percent of the time. Technically, these mental gymnastics are called rejection of the "null hypothesis."

The reason for this background argument is that the software package from Wolach and McHale really works.

Many software packages from houses like Microsoft, Sorcim, Ashton-Tate contain long caveats that they do not guarantee the performances of their software in any specific applications, etc. Perhaps Wolach and McHale should have included a similar warning since people seem to abuse the application of statistics more than any other discipline. The programs can be misused if one does not use the proper test in the proper circumstances.

Although the book has 12 programs, it has really only two main types of tests, namely, the t-test and the analysis of variance.

Clearly the t-test, which tests the distribution about the means (averages) of two groups to see if they are different by chance alone, is designed to compare two groups, e.g., to see if Brand A mouse trap catches more mice than Brand B under the same test conditions. In the first t-test in the book, one can test 5 Brand A vs. 10 brand B, and have a valid test. In the second test, the measurements must be equal in number, i.e., paired observations.

The analysis of variance is to be used in such cases where Brand A is compared to brands B, C, D for the number of mice they can catch. This is a one-way problem; two and three way analysis allows for varying such factors as the kind of

Lawrence A. Kelly, 28 Countrywood Dr., Morris Plains, NJ 07950.

Statistics looks at a small sample of the universe to help us decide whether the sample is representative and better of worse than the rest of the universe.

mouse caught or whether using bread in the trap is better than cheese.

I entered three or four of the listings in the book. The convention of underlining the "tokens" is quite helpful. The tapes all LOADed the first time (3/4 volume) with no problem. Each of the 12 programs worked perfectly as described in the helpful examples.

For comparison to Wolach and McHale I chose a report from "Some Statistical Methods Useful in Circulation Research" by Sylvan Wallenstein, Christine L. Zucker, and Joseph L. Fleiss in *Circulation Research,* an official journal of the American Heart Association. The editors had requested the authors, all biostatisticians, to study the statistical methods applied in the journal over the years 1970-80 and to comment on the appropriate or inappropriate use of statistics. They found that the t-test and analysis of variance were the most widely used tests and that the t-test was the only test used in most studies reported in the journal to the almost total exclusion of the analysis of variance which in most cases was the more appropriate test. Wolach and McHale must realize this since they present only two approaches to the t-test and 10 to the analysis of variance.

Table 1 describes the results of the data published compared to the results from Wolach and McHale's program. The test was a randomized block design done by program BMDP2V (Dixon and Brown, *Biomedical Computing Programs,* P series, Berkeley: Univ. of California Press, 1977) on an IBM 370 in batch mode through IBM VSPC and by #7RBKE (Wolach and McHale) on a kit-built ZX81 in an interactive mode in real time.

The book provides many fine references to experimental design and the proper application of each of the tests in the package. Students of statistics, or anyone wishing to know more on the subject, will find an excellent course of study using the references listed by Wolach and McHale, their trusty TS1000, and the tapes available with the book. ■

Table 1.
Analysis of Mitral Regurgitrant Orifice Areas.
Circulation Research, July 1980, p. 8.

Source of variation	Sum of squares	df	Mean squares	F
Wolach and McHale				
Dog (row)	1600	4	400	44.7761
Time (column)	852.55	3	284.18333	31.8115
Residual	107.2	12	8.933335	-
Total	2559.75	19	-	-
Wallenstein et al.				
Dog (row)	1600	4	400	
Time (column)	852.6	3	284.2	31.8
Residual	107.2	12	8.93	-
Total	2559.8	19	-	-

Book Review

The ZX81 Companion *Paul Grosjean*

The ZX81 Companion, by Robert Maunder, Creative Computing Press, 131 pp., $9.95.

The ZX81 Companion, like other ZX81 books, is totally applicable to the TS1000. It begins with a chapter on graphics techniques. First the screen field is explained. Then PLOT and UNPLOT are used to develop the basic components in graphics: drawing straight lines, using triangles, circles, parabolas, and ellipses, and moving a point around the screen. After the PRINT AT instruction is discussed, it is combined with INKEY$ to create real-time programs.

For users who want to develop their own data processing and retrieval systems, Chapter 2 may be worth the price of the book alone. String handling and design of programs to handle data are taken up first and then a program for file processing is developed using a modular approach.

Chapter 3 introduces educational uses with about 10 illustrative programs and games (including six 16K programs) for spelling and math, including the use of grids.

Chapter 4 is intended for the more experienced programmer who is ready to delve into the secrets of the 8K ROM and machine code and put them to work for him. The heart of this chapter is the two page list of the starting points for most of the useful ROM routines and the 11 page ROM disassembly (hex addresses, codes, and mnemonics). This does not cover the entire ROM, only the parts most easily usable by the programmer. The listing is small, but readable.

Each chapter is well illustrated with drawings, diagrams, and program listings. These programs include the program outlines, variable lists, and comments. Exercises allow the reader to try out the points being developed, and answers are given for self checking. The book is typeset, including the over 60 program listings. Although this makes the listings much easier to read, they do not follow the screen format of the computer. The brief index includes program names as well as topics.

The Appendix is a particularly valuable section because it deals with the design and development of a program as a whole by dividing the task up into a series of steps and taking the reader through the process.

This is a book for users who are ready to move beyond the manual to expand their use of graphics, to tackle bigger programs, and to use the ROM more effectively. ■

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Book Review

Byteing Deeper into Your Timex Sinclair 1000

Sharon Zardetto Aker

Byteing Deeper into Your Timex Sinclair 1000 by Mark Harrison. John Wiley & Sons. 160 pp. Softbound. $12.95.

Byteing Deeper into Your Timex Sinclair 1000 is catchy title, but do not take it too literally since the book was originally written for the ZX81 and retitled. Nevertheless, the content applies completely to the TS1000. More importantly though, it does not just "byte" deeper than the User's Manual, it covers many of the basics in a more easily digestible manner.

If you have already had some TS1000 experience, you might want to skip over the first few chapters. While they are not unworthy of study, the real meat begins with chapter 5.

The first program (p. 35) is a simple three-liner that fills the screen with whatever is input. It will hook you on Sinclair graphics possibilities, and, if you like what Harrison can do with INPUT, PRINT, and GOTO, just wait until you see what he does with INKEY$.

All the commands and functions are introduced, explained, and used in the 37 illustrative programs. Games run the gamut from "Dice" and "Baccarat" to "Destination Saturn" and "Black Holes." The programs for alphabetizing and line renumbering will get a lot of use, and you will want to become familiar with "Word Processor" before you buy that printer you have been promising yourself.

Although the explanation of plotting circles and ellipses assumes the reader has a knowledge of trigonometry, the uninitiated can use the formula programs.

The chapter on PEEKing and POKEing shows how to use the memory locations in the ROM and the RAM. When you write your own game programs, you will return repeatedly to the sample uses of PEEK and POKE. While the introduction to machine code will not make you a machine code programmer, it will help you understand and use more confidently the many machine code programs available for ZX/TS computers.

The brief, but thorough, section on the logical functions might well be the highlight of the book. Understanding the true/false testing capability of the Sinclair will lead to more elegant programming, and knowing how to replace lines of IF/THENs with a concise AND/OR will save memory.

The last section on "Projects" (hints, not answers, are provided) is uncomfortably like a final exam. If, however, you can handle the projects, you will know that you know your stuff. Harrison knows his stuff, and he explains it well.

If you were totally lost half way through your Manual, this book is not the best to turn to. Although its explanations are clear and concise, it moves quickly and does not give you second chances. However, if you are in need of some clarification or if you might benefit from a different approach, this is a book to buy. At first glance, *Byteing Deeper* seems a slim volume for its price tag, but the wealth of information packed into it justifies the expense.

Sharon Zardetto Aker, 20 Courtland Dr., Sussex, NJ 07461.

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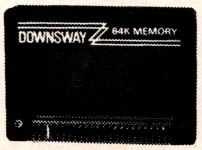

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The Logical Operators

Sharon Zardetto Aker

AND and OR have two distinct usages in Sinclair Basic. One mirrors their use in English and is easily understood; the second is less straightforward, but is an extremely versatile programming technique. NOT, the third logical operator, is unfortunately overlooked or ignored by many beginner programmers; it, too, can be a powerful programming tool.

You must understand the computer's view of "truth": a true condition is "1"; a false condition is "0".

AND and OR

```
IF A<10 AND B<10 THEN...
IF A<10 OR B<10 THEN...
```

In the first example, the command following THEN is executed if *both* conditions are true (the conditions being A < 10 and B < 10). In the second example, as long as *either* condition is true, the command will be executed.

AND has a higher priority than OR and is performed first regardless of its position in the conditional statement.

```
IF X>5 OR Y>5 AND Z>5 THEN...
```

This statement sets up two conditions:

```
1) X>5
2) Y>5 AND Z>5
```

Since they are linked by OR, either one being true will cause the command to be executed.

To circumvent the computer's automatic ordering of operations, parentheses should be used.

```
IF (X>5 OR Y>5) AND Z>5 THEN...
```

The two conditions in this statement are:

```
1) X>5 OR Y>5
2) Z>5
```

Since they are linked by AND, both conditions must be true for command execution.

You should note that, in this last example, there are actually two combinations that will satisfy the computer's truth-check:

```
1) X>5 AND Z>5
2) Y>5 AND Z>5
```

Instead of IF-THEN

AND and OR also have another, entirely different, usage in Sinclair Basic, one that allows you to combine several IF-THEN statements into one logical statement that does not even use IF-THEN.

```
IF A<10 THEN GOTO 125
IF A=10 THEN GOTO 300
IF A>10 THEN GOTO 480
```

can be rewritten:

```
GOTO (125 AND A<10)+
  (300 AND A=10)+
  (480 AND A>10)
```

To translate this into understandable English, read each AND as "if." The computer looks at each one of the parenthetical statements and checks the truth of the expression following AND. If that conditional statement is true, the value of the parenthetical statement is set at whatever precedes AND; if the expression is false, the statement is assigned a 0.

So in this last example, if A is 14, the line will work out as in Figure 1. The computer will GOTO 480.

Mutual Exclusivity

The parenthetical statements in the above example are mutually exclusive; that is, if one is true, the others have to be false. That is not always the case, and you should plan carefully in a situation like the following:

```
IF N<10 THEN GOTO 100
IF N=10 THEN GOTO 150
IF N<20 THEN GOTO 200
```

Obviously, N can be less than 10 and less than 20 at the same time; so can it be both equal to 10 and less than 20. As long as the IF-THEN statements are in the right order in your program ("right" depends on the effect you want), there is no problem because the computer will act upon the first true statement it encounters and never see the one(s) following.

However, if you rewrite these statements using the logical operators, you

Figure 1.

```
GOTO (125 AND A<10) + (300 AND A=10) + (480 AND A>10)
          false              false              true
GOTO      (0)       +        (0)       +        (480)
```

Figure 2.

```
GOTO (100 AND N<10) + (150 AND N=10) + (200 AND N<20)
          false              true               true
GOTO      (0)       +        (150)     +        (200)
```

Sharon Zardetto Aker, 20 Courtland Dr., Sussex, NJ 07461

would have a *big* problem. If N is 10, the computer would make the evaluation found in Figure 2 and execute GOTO 350.

Further definition of one or more of the conditions, until the parenthetical statements *are* mutually exclusive, is necessary. For instance:

```
IF N<10...
IF N=10...
IF N<20 AND N>10...
```

Written logically,

```
GOTO (100 AND N<10)+
  (150 AND N=10)+
  (200 AND (N<20 AND N>10))
```

In the last parenthetical statement, the first AND operates as "if." The second AND operates in its usual manner requiring that both conditions be true for the total expression to be true. The inner parentheses are not strictly necessary, since the first AND will always be used as the "if"; they were included here only to make the example clearer.

Other Commands

Since the entire logical expression boils down to a number, it can be used in place of a number with many different commands:

```
PRINT AT (5 AND Z>14)+
  (2 AND Z<5),10;''OKAY''
PLOT X, (17 AND B=12)+
  (27 AND B<>12)
GOSUB (500 AND L=10)+
  (800 AND M=10)
PRINT (0 AND N<>10)+
  (N AND N=10)
PAUSE (120 AND T<10)+
  (380 AND T>=10)
```

Strings

Strings can also be used with logical statements. If the conditional expression is true, the parenthetical expression is "equal to" the string before AND. If the conditional expression is false, the statement is considered to be an empty string. So:

```
IF A>B THEN PRINT ''TOO HIGH''
IF A<B THEN PRINT ''TOO LOW''
```

can be rewritten as:

```
PRINT (''TOO HIGH'' AND A>B)+
  (''TOO LOW'' AND A<B)
```

When A is larger than B, the statements will be evaluated:

```
PRINT (''TOO HIGH'')+('''')
```

You can also assign a string value with this syntax:

```
LET P$=(''TOO HIGH''
  AND A>B)+
  (''TOO LOW'' AND A<B)
```

A logical expression for strings or numbers does not have to consist of alternative choices; a parenthetical logical expression can be inserted into an otherwise straightforward command. Consider a program that would display a multiplication problem of two randomly generated numbers (A and B) and a player's answer (C). If the answer is wrong, you might want it marked with an asterisk.

```
PRINT A;''*'';B;
  TAB 10;(''*''
  AND C<>A*B);TAB 11;C
```

If the answer is correct, nothing will be printed at TAB 10.

Variable Re-valuation

Logical expressions that change the value of a variable are easy to use. Here is one example, and the ways it would be evaluated.

```
LET X=X+(5 AND B<A)+(7 AND B>A)
If B<A   X+  (5)  +  (0) =(X+5)
If B>A   X+  (0)  +  (7) =(X+7)
If B=A   X+  (0)  +  (0) =(X)
```

As you can see, there is no need to write a statement for the B=A possibility if you want X to remain the same in that situation.

If the variable is to be decremented, change the plus sign to a minus sign:

```
LET N=N+(5 AND P=0)-
  (5 AND P<>0)
```

This will be evaluated in one of two ways:

```
If P=0:    N+(5)-(0) = N+5
If P<>0:   N+(0)-(5) = N-5
```

Using OR

While AND is used for strings and numbers, and variable re-valuation involving addition and subtraction, OR is only practical for re-valuations involving multiplication or division. A study of the chart in Figure 3 might help you understand why this is so.

When OR is used in this construction, read it as "unless":

```
LET N=N*(10 OR A>B)
```

If B is less than A, the statement is true. It is evaluated as 1 (as noted in the chart), and reads:

```
LET N=N*(1)
```

and the value of N does not change.

If B is *not* less than A, the parenthetical statement is assigned the value of the number before OR:

```
LET N=N*(10)
```

So, N is multiplied by 10 *unless* B is less than A, in which case N remains the same.

If you were writing a program to calculate new prices for merchandise going on sale, where items less than $100 were to be reduced by 10% and all others by 20%, your statement would read (P is the current price):

```
LET P=P*(.8 OR P<100)*
  (.9 OR P=100)
```


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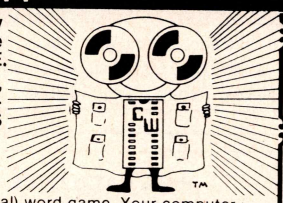

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```
If P<100:    P*(1)(.9) =P*.9
If P>=100:   P*(.8)(1) =P*.8
```

Non-exclusive Statements

You may not always want parenthetical statements in a variable re-valuation to be mutually exclusive.

Consider a game where a player receives 10 points for hitting at least ten targets, and a bonus of 20 points for hitting exactly ten targets.

```
LET SCORE=SCORE+
  (10 AND H>9)+
  (20 AND H=10)
```

When H is ten, both expressions are true and SCORE is incremented by 30 points.

ORs do not have to be mutually exclusive, either. Consider the change in a game score caused by the following:

```
LET S=S*(10 OR H<5)*
  (10 OR H<10)*
  (10 OR H<15)
```

If H is less than five, all three statements are true, evaluated as 1, and S (the score) does not change at all. As the value of H gets higher, the score will be multiplied by 10, 100, or 1000, depending on how many of the parenthetical statements are true:

```
If H is 7:
  S=S*(10)*(1)*(1)     =S*10
If H is 12:
  S=S*(10)*(10)*(1)    =S*100
If H is 19:
  S=S*(10)*(10)*(10)   =S*1000
```

NOT

To make use of NOT, you must first understand the computer's view of "truth." Conditions in an IF-THEN statement are evaluated, and a true condition is assigned a one, while false one are assigned zero. (Note the "result" column in Figure 3.)

Furthermore, any mathematical expression whose result is zero is considered false, while a non-zero result (even a negative number) is true.

NOT changes the true/false value of an expression:

If A is false, NOT A is true.
If A is true, NOT A is false.

Applications

If you would like a command executed every second time it is encountered in a loop, use NOT to change the true/false value of a variable back and forth. With:

```
IF V THEN...
```

at the beginning of a loop, and:

```
LET V=NOT V
```

later in the loop, V will be true on every other loop.

By using

```
LET E=N/2-INT(N/2)
```

E is zero whenever N is an even number. To have a command executed only when N is even, use

```
IF NOT E THEN...
```

Similarly,

```
LET I=N-INT N
```

means that I is zero whenever N is an integer, and

```
IF NOT I...
```

will be a true condition when N is a whole number.

Priority

NOT is assumed to apply only to the number to its right, unlike the other logical operators, which automatically apply to an entire expression.

```
NOT B<C
```

is interpreted as:

```
(NOT B)>C
```

NOT has priority over both AND and OR, so the following conditional statement would be processed in the order of innermost brackets first:

```
IF [[[NOT A] AND B] OR C]
```

The use of NOT can, of course, be altered by the use of parentheses.

A Demonstration Program

"Dots" is a sketcher program that illustrates the use of the logical expressions to change the value of a variable.

You will be drawing with colons in this program, which gives an interesting effect, since a double row of dots is printed when you move horizontally, and a single row if you move vertically. You can also move diagonally, and if you go off the edge of the screen, the line will continue from the opposite edge.

Figure 3.

Operator	Conditional Choice	Conditional Expression	Result
AND	A$	true	A$
AND	A$	false	"" (empty string)
AND	N	true	N
AND	N	false	0
OR	N	true	1
OR	N	false	N

The keys surrounding F on the keyboard control the movement: T is for straight up, V for diagonally down to the left, and so on. Pressing G will stop the program.

Line Notes

20,30: Set initial value of L (line number) and C (column number) so colon is printed in screen center.

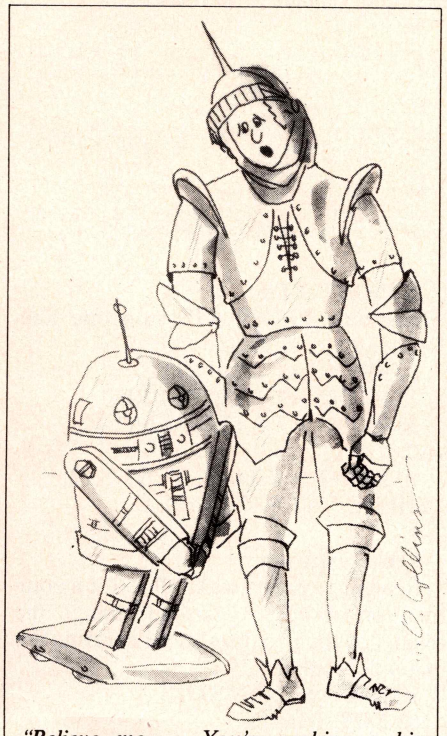
80,90: Change line and column numbers according to which key has been pressed. The AND in the parenthetical statements operate as "if." The ORs operate in the basic manner.

100,110: Reset the line and column numbers if the new values result in a

```
  5 REM "DOTS"
 10 REM BY ZARDETTO AKER
 20 LET L=11
 30 LET C=16
 40 PRINT AT L,C;":"
 50 IF INKEY$="" THEN GOTO 50
 60 LET M$=INKEY$
 70 IF M$="G" THEN STOP
 80 LET L=L+(1 AND M$="B" OR M$
="N" OR M$="V")-(1 AND M$="R" OR
 M$="T" OR M$="Y")
 90 LET C=C+(1 AND M$="Y" OR M$
="H" OR M$="N")-(1 AND M$="R" OR
 M$="F" OR M$="V")
 100 LET L=L+(22 AND L=-1)-(22 A
ND L=22)
 110 LET C=C+(32 AND C=-1)-(32 A
ND C=32)
 120 GOTO 40
```

number that would not be on the screen. If L is −1, adding 22 to it makes it 21, and places the print position at the opposite edge of the screen; if L is 22, subtracting 22 puts the print position at zero.

You should note that the diagonally drawn lines result from L and C changing on the same loop. ■



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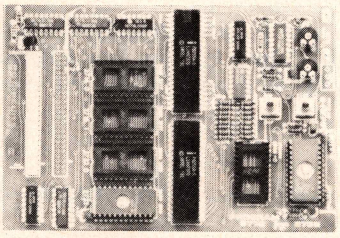

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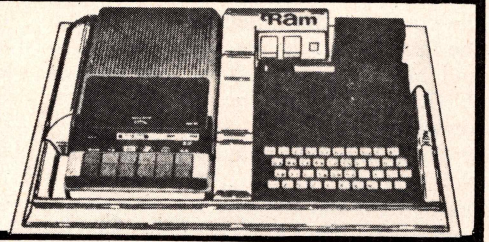

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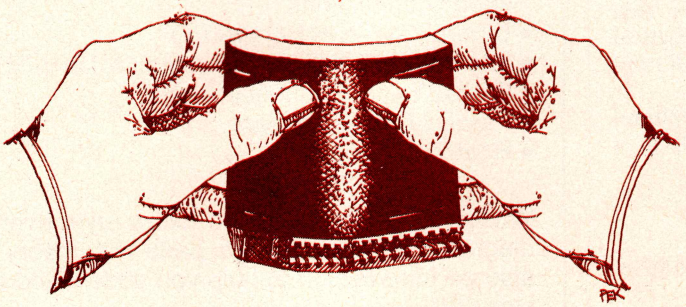
Memory Scrunching on the TS1000 and ZX81

James Grosjean



One of the most serious problems that TS1000 users are faced with (and ZX81 users even more so) is the lack of memory (RAM). Most commercial programs require a 16K RAM pack, and many printed in newsletters and magazines require over 2K (or 1K for ZX81 people). Although the package or listing calls for 16K, this does not mean that the program is 16K long. It just means that you must have more RAM than your machine comes with and 16K is the next increment.

If you do not intend to expand your system RAM, the only solution is to shorten programs which might fit then into your RAM.

This article collects over thirty tips to save memory. Some of them have appeared in *SYNC*; hopefully some of them are new to you. Some are simple, obvious hints, while others require some clever programming. When dealing with 2K (or less) every byte counts!

You can calculate the bytes in the various lines as follows: Line numbers take up two bytes no matter whether the number is 1 or 9999. Between the line number and the text of the line in the computer's memory are two bytes telling the computer how long that line is from the first byte of the text of the line up to and including the end of line marker (CHR$ 118). In the line itself all letters, keywords, etc., typed by a single keystroke take up one byte except numbers. Numbers take up six bytes plus the number of digits and one byte for the decimal point if any. After the text of the line is an end of line marker telling the computer where the line ends. This marker takes one byte.

James Grosjean, 50 Kings Rd., Chatham, NJ 07928.

A program may require the 16K RAM pack, but that does not mean it uses 16K RAM.

Memory Scrunching Tips

1) REM statements

Eliminate REM statements and include them in your documentation.

2) Game elements

Eliminate one or more game elements. This might make the game fit into 2K.

3) Restart mechanisms

Omit restart mechanisms completely. E.g., "Do you want to play again? Y or N."

4) STOP statements

If the last program line is a STOP statement, delete it. The program will stop anyway only with a different error code.

5) Keywords and tokens

Use keyword and token expressions. When entering a line such as:

10 REM TO RUN USE GOTO 100

use the keywords for the words TO, RUN, and GOTO. This line is entered by typing exactly: 10, E (REM), SHIFT 4 (TO), SHIFT 3 (THEN), R (RUN), SHIFT 5 (BACKSPACE), SHIFT 0 (DELETE THEN), SHIFT 8, U, S, E, SHIFT 3 (THEN), G (GOTO), SHIFT 5 (BACKSPACE), SHIFT 0 (DELETE THEN), SHIFT 8, 1, 0, 0, ENTER. Do this several times to get used to it. If necessary, reword prompts to allow for this technique.

6) PRINT statements

Shorten or eliminate PRINT statements, and include the information in your documentation in a notebook for programs. For example, replace A with B.

A: 10 PRINT "DATE OF BIRTH?"

B: 10 PRINT "BIRTHDATE?" or "BORN?"

7) Commas

When lining up PRINT lines, use commas or hyphens instead of spaces. For example, replace A with B or C.

A:

```
10 PRINT "DO YOU WISH TO FIGHT
THE        CENTIPEDE OR FLEE?"
```

B:

```
10 PRINT "DO YOU WISH TO FIGHT
THE","CENTIPEDE OR FLEE?"
```

C:

```
10 PRINT "DO YOU WISH TO FIGHT
THE CENTI- PEDE OR FLEE?"
```

8) PRINT AT's

Combine PRINT AT's into one line. For example, replace

10 PRINT AT 2,14;"HI"
20 PRINT AT 5,12;"THERE,"
30 PRINT AT 8,12;"SALLY"

with

10 PRINT AT 2,14;"HI";AT 5,12; "THERE,";AT 8,12;"SALLY"

9) Combine lines

Rearrange programs to allow for a combination of lines. This can change the results of the program so be careful. For example, replace

50 IF Y=9 THEN STOP
60 INPUT I$
70 IF I$="YES" THEN STOP
80 GOTO 20

with

```
50 INPUT I$
60 IF Y=9 OR I$="YES" THEN STOP
70 GOTO 20
```

Remember to change GOTOs and GOSUBs to their new line numbers.

10) Parentheses

Eliminate unnecessary parentheses. For example, replace A with B.

```
A: 10 LET I=(A*10)+(B*5)
B: 10 LET I=A*10+B*5
```

Because of the order of operations (refer to manual) this will be evaluated properly.

11) Conditional statements

In certain cases a condition can be changed without changing the effect. For example, replace A with B.

```
A: 10 IF Y=10 THEN PRINT "YOU KILLED IT."
B: 10 IF Y>9 THEN PRINT "YOU KILLED IT."
```

This saves one byte because 9 has only one digit. However, if floating point numbers are utilized in the program, this technique may not work.

12) Variable names

Do not use words for variables. Replace A with B.

```
A: 10 LET STRENGTH=10
B: 10 LET S=10
```

Include variable descriptions in your documentation.

13) IF...THEN STOP

If a line contains a conditional jump to a STOP statement, replace it with an IF...THEN STOP statement. For example, replace

```
100 IF Y<10 THEN GOTO 400
      .
      .
400 STOP
```

with

```
100 IF Y<10 THEN STOP
```

14) Arrays

Do not set up an array with more elements than needed. If 54 elements are required, use DIM A(54), not DIM A(60).

15) 0 in arrays

Eliminate statements which initially set array elements to 0. For example,

```
10 DIM A(4)
20 LET A(1)=0
30 LET A(2)=1
40 LET A(3)=0
50 LET A(4)=9
```

Delete lines 20 and 40. After execution of line 10 all elements are set to 0 automatically.

16) CLEAR

Try to use the CLEAR command if possible. CLEAR can sometimes save a program just before it runs out of memory. CLEAR is one of the least used commands in Basic.

17) GOTO/CLEAR

In *very* rare cases RUN can replace a GOTO/CLEAR combination. For example:

```
65 CLEAR
70 LET A=7
      .
      .
175 GOTO 65
```

Delete line 65 and change 175 to 175 RUN 70. Because RUN clears all variables, it can replace a CLEAR and a GOTO.

18) One time variables

If a variable is only used once do not assign the variable. For example, replace

```
10 LET D=INT (RND*10)+1
20 FOR I=1 TO D
30 PRINT "■"; (inverse space)
40 NEXT I
```

with

```
10 FOR I=1 TO INT (RND*10)+1
20 PRINT "■"; (inverse space)
30 NEXT I
```

This allows you to delete a line (with a

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slight lengthening of another) and not assign an unneeded variable.

19) Reuse variables

Reuse variables. Once a variable has been assigned it remains in memory, even if it is not used again in the program (unless RUN, CLEAR, or NEW is used). Look at this program:

```
10 FOR X=1 TO 10
20 PRINT "          ";
       (10 inverse spaces)
30 NEXT X
40 LET D=INT (RND*10)+1
50 PRINT "YOUR STRENGTH IS ";D
```

The variable X will take up memory until RUN, CLEARed, or NEWed. Even though no longer used, it occupies precious bytes of RAM. A better program would be:

```
10 FOR X=1 TO 10
20 PRINT "          ";
       (10 inverse spaces)
30 NEXT X
40 LET X=INT (RND*10)+1
50 PRINT "YOUR STRENGTH IS ";X
```

Now, instead of both X and D stored in memory, only X is in memory.

20) Reuse variables without reassignment

In certain cases a variable can be reused without being reassigned. For example:

```
10 FOR X=1 TO 10
20 PRINT "          ";
       (10 inverse spaces)
30 NEXT X
40 LET X=11
50 PRINT "YOU NOW HAVE ";X;" GOLD PIECES."
```

Line 40 can be deleted. After completing the loop X is already equal to 11. However, not many variables are initially set to 11; ten is more likely. Thus:

21) FOR-NEXT variable range

Replace the previous example with:

```
10 FOR X=0 TO 9
20 PRINT "          ";
       (10 inverse spaces)
30 NEXT X
40 PRINT "YOU NOW HAVE ";X;" GOLD PIECES."
```

After the loop X equals 10, which is easier to work with than 11. This also saves memory. The number of bytes needed to store an integer equals the number of digits plus six. In line 10, the use of 0 and 9 saves one byte in place of 1 and 10, because 10 has two digits and 9 has one. Compare:

Tip 21:
0 = 1 + 6 = 7 bytes
9 = 1 + 6 = 7 bytes
for a total of 14.

Tip 20:
1 = 1 + 6 = 7 bytes
10 = 2 + 6 = 8 bytes
for a total of 15.

22) Number substitutes

Because numbers require a minimum of seven bytes of memory, too many numbers quickly fill up the RAM. Therefore, replace line A with line B below.

A: 10 LET E=0
B: 10 LET E=NOT PI

0 requires 7 bytes; NOT PI uses 2 bytes. Some other expressions for 0 are USR PI, SIN PI, and TAN PI, each requiring two bytes.

A: 10 LET E=1
B: 10 LET E=SGN PI

1 requires 7 bytes; SGN PI uses 2 bytes

A: 10 LET E=3
B: 10 LET E=INT PI

3 requires 7 bytes; INT PI uses 2 bytes
Some other expressions and their equivalents are:

COS PI = -1
PEEK PI = 255
PEEK NOT PI = 211
PEEK SGN PI = 253
PEEK PEEK PI = 135
LEN STR$ PI = 9
CODE STR$ PI = 31

This list is by no means complete.

For any other numbers use VAL (see tips 23 and 24 for exceptions) as shown in B below to replace A.

A: 10 LET E=2
B: 10 LET E=VAL "2"
A: 10 LET E=327
B: 10 LET E=VAL "327"

In each case the use of VAL saves three bytes. Note:

2 = 7 bytes
VAL "2" = 4 bytes

I have yet to find a better expression to replace VAL "2".

327 = 9 bytes
VAL "327" = 6 bytes

This tip is used not just in assigning variables. One of the above methods can be used to substitute for a number anywhere a number is used.

However, do not put VAL around each number in an expression:

```
10 LET E=(INT (RND*VAL
"10")+VAL "5")*VAL "100"
```

Instead put VAL around the entire expression:

```
10 LET E=VAL "(INT (RND*10)+5)
*100)"
```

This way you get the most out of VAL.

Remember, though, that extensive use of VAL, NOT PI, etc., can slow down a program tremendously, but that is the sacrifice for memory saving.

23) VAL exception

An exception to the use of VAL is sometimes encountered:

```
10 FOR X=NOT PI TO VAL "20"
```

VAL "20" uses five bytes. If this line is replaced with:

```
10 FOR X=NOT PI TO EXP INT PI
```

two bytes may be saved. EXP INT PI uses only three bytes. Although EXP INT PI = 20.085537, this is rounded to 20 when used in combination with FOR. This means that in the revised program in tip 18, the INT in line 10 may be deleted. EXP PI could substitute for the number 23 using the same method.

24) Variable instead of VAL

Another exception is when a single number is used many times. Assign a variable to it instead of using VAL. For example, replace

```
20 IF I>10 THEN GOTO 80
22 INPUT I$
24 IF I$="FIGHT" THEN GOTO 80
26 IF A>80 THEN GOTO 6400
28 LET U=B+80
30 IF U/T>80 THEN GOTO 251
```

with

```
10 LET Y=80
20 IF I>10 THEN GOTO Y
22 INPUT I$
24 IF I$="FIGHT" THEN GOTO Y
26 IF A>Y THEN GOTO Y*Y
28 LET U=B+Y
30 IF U/T>Y THEN GOTO Y*PI
```

25) Strings in PRINTs

Similarly, if the same set of characters must be PRINTed several times, assign a string variable to those characters and PRINT that string. Keep in mind that it takes up memory to assign the variable as well as to keep the variable in the variable storage of the computer. So use this method only when the string must be PRINTed enough times to make it worthwhile.

26) Destination changes

Change GOTO (or GOSUB) destinations. For example:

```
10 GOTO 100
    .
    .
100 PRINT "YOU FACE A DRAGON"
    .
    .
```

Line 10 can be changed to 10 GOTO 99 and take advantage of a characteristic of the TS1000, namely, that, if the GOTO or GOSUB destination line does not exist, the computer skips over it and goes to the next line. Thus in the example above, the computer, finding no line 99, will go on to 100. This saves one byte since 99 has two digits, not three.

27) Calculated destinations

The following is often seen in a program:

```
100 IF I=1 THEN GOTO 1000
110 IF I=2 THEN GOTO 2000
120 IF I=3 THEN GOTO 3000
130 IF I=4 THEN GOTO 4000
```

This can be replaced with a calculated GO TO. For example:

```
100 GOTO I*1000
```

If your program is not numbered to allow a calculated GOTO, renumber it, or:

28) Logical destinations

Use a bit of logic. For example, the following lines:

```
10 IF I=1 THEN GOTO 100
20 IF I=2 THEN GOTO 219
30 IF I=3 THEN GOTO 235
40 IF I=4 THEN GOTO 900
```

can be replaced by:

```
10 GOTO (I=1)*100+(I=2)*219+(I=3)*235+(I=4)*900
```

Of course, we could use VAL around that expression.

```
10 GOTO VAL "(I=1)*100+(I=2)*219+(I=3)*235+(I=4)*900"
```

29) Logical combinations

Use logic to combine statements. For a detailed discussion of the logical oper-

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ators and techniques see Sharon Aker's article in this issue.

30) Replacements
Replace A with B:
A: 10 IF Y=0 THEN...
B: 10 IF NOT Y THEN...
A: 10 IF Y <> 0 THEN...
B: 10 IF Y THEN...

31) Shortened restarts
This is a very impressive tip. Many games have a restart mechanism. For example:

```
810 PRINT "ANOTHER GAME? (Y/N)"
820 INPUT A$
830 IF A$="Y" THEN RUN
```

This can be shortened, but a few simple adjustments are needed:
Change 820 to 820 INPUT A
Change 830 to 830 RUN
and make sure one of the program's variables is Y and none are N. Then, if "Y" is entered in response to the prompt in line 810, the computer will accept that as a legitimate response (because of the expression evaluator) and continue to line 830, where the program will be RUN. If "N" is entered, the computer will stop with an error code 2/820. This is what your final program would look like:

```
10 LET Y=10
    .
    .
810 PRINT "ANOTHER GAME? (Y/N)"
820 INPUT A
830 RUN
```

Do not add a line in assigning the variable Y. Change one of the other variables in the program to Y. It is presumed that line 10 above had previously used a different variable such as 10 LET A=10.

32) False saving
There is one technique which some programmers use in an attempt to save memory, but it actually wastes memory instead. Lines such as these:

```
10 PRINT "YOU HAVE NO STRENGTH"
20 PRINT
```

are replaced with

```
10 PRINT "YOU HAVE NO STRENGTH",,
```

and then line 20 is deleted. This appears to save 4 bytes. Actually it wastes memory. The PRINT statement puts an end of line marker into the display file. Therefore a blank line on the screen takes up one byte when created by a PRINT used by itself as in line 20. When a comma is used, the computer fills the display file with spaces until the proper print position is attained. So it is better to have a slightly longer program than a much larger display file.

When all these tips are used, a program can often be reduced by as much as 50 percent. Note that in many of the above examples the revised program lines can be shortened even more by using some of the other tips in this article, but that would make the examples confusing.

Speed Tips

Along with the problem of memory, TS1000 and ZX81 users often complain about speed. Here are a few tips to increase the speed of a program:

1) Unnecessary calculations
Eliminate unnecessary calculations. VAL, NOT PI, and other memory savers slow down the program. Replace A with B.

```
A: 10 LET U=Y*20/4*X
B: 10 LET U=Y*5*X
```

2) Unnecessary lines
Delete unnecessary lines, e.g., REMs.

3) Eliminate GOTOs
Rearrange the program to eliminate as many GOTOs as possible.

4) Subroutines up front
Subroutines used often should be located as near the beginning of the program as possible. When the computer comes across a GOTO or GOSUB, it searches for its destination line from the beginning of the program.

5) Redundant GOTOs
In situations like this:

```
30 GOTO 180
    .
    .
180 GOTO 90
```

Change 30 to 30 GOTO 90.

6) Arrangement of variables
Assign the variables that are used the most first. When the computer comes across a variable, it searches through its variable area from the beginning to the end. Variables are stored in the order that they are assigned.

As a general rule, speed is often given up for memory saving and vice versa, unless machine language is used. Machine language is FAST and short.

This collection of memory saving tips is by no means complete. If you can add to the collection, send your tip to *SYNC*. Be sure to give examples. ■

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John Richard Coffey

Introduction

The Z80 microprocessor is the brain of your Sinclair computer. By itself, however, it is not very smart. It has no capacity to understand commands like PRINT and LET. When you use these commands, you are not directly telling the Z80 what to do. What the commands do is give instructions to the *interpreter.* The interpreter is itself a computer program and is located in memory locations 0 to 8191. It is written in a language the Z80 can understand called "machine language" or "machine code." This language consists of numbers between 0 and 255. A table of these numbers and their mnemonics can be found in the Basic manual. A mnemonic is a label assigned to each machine code that more or less describes what it does.

We can write our own machine code programs, but it is not an easy process. The main advantage to writing them is that they execute very fast. They also do not take up much memory and sometimes are more flexible than Basic. The three Basic commands that deal with machine code are PEEK, POKE, and USR. PEEK allows you to examine a memory location and POKE allows you to change it. The USR routine tells the Z80 to start executing machine code at a particular location. Before you can use the POKE command to put numbers into memory you must first reserve an area for them. The Basic manual gives a detailed discussion of how to do this.

Presented below in Figure 1 are four machine code routines which imitate features that are standard on more expensive computers and that will extend your 8K ROM by adding new commands.

John Richard Coffey, PO Box 448, Scottsburg, IN 47170.

Figure 1. Summary of new routines.

The Routines

COMMAND	DESCRIPTION
10 RAND USR IV	Convert every character on screen to its inverse.
10 PRINT USR FM	Print how many free bytes are in memory.
10 GOTO Z	Create an inverse program listing.
10 REM 10.3, SIN A, 500 REM ABE,IKE	These are two pseudo-DATA statements. They can be placed anywhere in your program. Each entry can be numeric or string and is followed by a comma.
10 RAND USR RS	Perform the RESTORE command. This must be used before any data is read. It can also be used to read data more than once.
10 LET A$="" 20 RAND USR RD 30 LET A=VAL A$	READ the next data entry. Omit line 30 if you are reading a string.

Use Listing 1 to enter the machine code listed in Figures 2 through 5. Verify your articles with both the addresses and the checksums printed by the program. If you make a mistake, simply press to enter to erase the last entry. 1K users will have to use CONT when screen overflow causes the program to stop. After you type the last number, the program should stop. You should then delete all the lines of the program except the first by typing in the line number and ENTER.

With the one line still in memory, type and RUN Listing 2. It will save itself to tape, so prepare your recorder in advance. After the SAVE, press ENTER. The screen will flicker for a moment and Listing 2 will be gone. The machine code, however, will have been relocated to the top of whatever memory size you have.

Listing 1. Machine Language Loader.

```
   1 REM ************************
*******************************
*******************************
*******************************
************************
  10 LET A=VAL "16514"
  15 LET B=0
  20 SCROLL
  30 PRINT A;
  40 INPUT A$
  50 IF LEN A$ THEN GOTO VAL "10
0"
  60 LET A=A-SGN PI
  70 IF A<VAL "16514" THEN GOTO
10
  80 LET B=B-PEEK A
  90 GOTO 20
 100 POKE A,VAL A$
 110 LET B=B+PEEK A
 120 PRINT TAB 10;A$;TAB 20;B
 130 LET A=A+SGN PI
 140 IF A<=16661 THEN GOTO 20
```

Listing 3 demonstrates the use of the various commands. It also declares the variables RS, RD, IV, FM, and Z. Note that Z is read from a REM statement. Start your recorder before running Listing 3, because it will also SAVE itself to tape. Afterwards you may want to delete all the lines except the last two, and

Write your own USR routines and give your 8K ROM Basic the commands of the expensive machines.

SAVE result. If you have not used NEW or CLEAR, then the variables will go to tape also.

The procedure for LOADING the new commands is simple: LOAD Listing 2. Press ENTER. LOAD Listing 3 or its shortened version described above. Caution: This short version will only work if you are using the same memory configuration you were using before the SAVE. It is a good idea to hold onto all of Listing 3 in case you need it.

Practical Uses

If you have a long print out and little memory, you will probably get an error "4" due to screen overflow. This can be prevented with a line such as the following:

```
50 IF USR FM < 100 THEN CLS
```

This will let you avoid having to type "CONT" to get your program going again. It might be a little annoying, however, if the screen clears without your having a chance to read it. So, perhaps the following two lines would be better:

```
50 IF USR FM < 100 THEN PAUSE
   40000
60 IF USR FM < 100 THEN CLS
```

This stops the program until you have had a chance to read the screen. Pressing any key will get it going again and will also clear the screen. Which version you use depends upon your application.

You can use the instant inverse routine to create some interesting visual effects. Listing 4 is a good attention catcher and would be useful in a shop window or in an exhibit at a computer fair. The first two lines create a collapsed display file and should be used only if you are using an expansion memory. Listing 5 shows how to create a full display (2K version). Listing 6 is a 1K version of the same thing.

On the television set that I use, inverse characters are much easier to read than normal ones. This is why I have included a "GOTO Z" feature. For me it is the only way I can read my programs. Not everyone will have this problem, but I am sure there are a few who do.

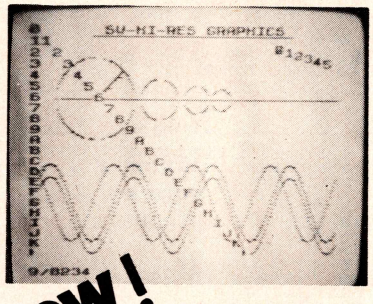
Listing 2.

```
  10 SAVE "2"
  20 LET A=VAL "PEEK 16388+256*P
EEK 16389"
  30 INPUT B$
  40 POKE 16515,129
  50 LET A=A-120
  60 LET B=A+3
  70 LET C=VAL "16550"
  80 GOSUB VAL "130"
  90 LET B=A+29
 100 LET C=VAL "16565"
 110 GOSUB 130
 120 PRINT USR 16634
 130 LET E=VAL "INT (B/256)"
 140 LET D=B-E*256
 150 POKE C,D
 160 POKE C+SGN PI,E
 170 RETURN
```

Listing 3.

```
   1 SAVE "3"
  10 LET RS=VAL "PEEK 16388+256*
PEEK 16389"
  20 LET RD=RS+42
  30 LET FM=RS+79
  40 LET IV=RS+94
  50 REM COMMANDS : (USR ) FM IV
RS RD , AND GOTO Z,9998,
  60 PRINT USR FM
  70 RAND USR RS
  75 FOR L=1 TO 3
  80 LET A$=""
  90 RAND USR RD
 100 IF L<3 THEN PRINT A$
 105 NEXT L
 110 LET Z=VAL A$
9998 LIST
9999 RAND USR IV
```

If you have to do any kind of record keeping, then the restore and read routines should be helpful. You can use



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the REM statements to store important telephone numbers, dates, appointments, birthdays, etc. They could also hold inventories, screen coordinates for plotting, machine code, or words like "CAT" and "DOG" for a computer version of "Hangman."

Listing 7 is an example of a computer telephone directory that runs in 1K. The other ideas mentioned above I will leave as exercises for interested programmers. Feel free to substitute other phone numbers in line 10. This same program can be used to store other kinds of data where one item is directly related to another. An English to Spanish translator would be an example.

Listing 8 will graph any function you give it. First, you must input the function in terms of X. For example, if you wanted to graph ($f(X) = 4X^2+3X+2$) then you would input 4*X*X+3*X+2. Then you have to input the lower and upper limits on X. If you were plotting a sine curve, for example, you would probably want to use limits of zero and two pi. The nice thing about this program is that the vertical limits are calculated automatically. This makes function plotting quite a bit easier.

Stored on REM statements are some functions you can select instead of your own. Each function is followed by its

Figure 2. Restore and READ String Routines.

Assembly	Listing	Address	Machine	Code		Checksum
RESTORE	LD HL,16634	16514	33	250	64	347
FIND	LD A,CODE "REM"	16517	62	234		643
	LD BC,65536	16519	1	255	255	1154
	CPIR	16522	237	177		1568
	LD BC,5	16524	1	5	0	1574
	AND A	16527	167			1741
	SBC HL,BC	16528	237	66		2044
	LD A,118	16530	62	118		2224
	CP (HL)	16532	190			2414
	JR Z,BELOW	16533	40	5		2459
	ADD HL,BC	16535	9			2468
STASH	LD (16507),HL	16536	34	123	64	2689
	RET	16539	201			2890
BELOW	ADD HL,BC	16540	9			2899
	JR FIND	16541	24	230		3153
READ						
CHARACTER	LD HL,(16507)	16543	42	123	64	3382
	LD A,118	16546	62	118		3562
	CP (HL)	16548	190			3752
	CALL Z,FIND	16549	204	33	64	4053
	LD A,(HL)	16552	126			4179
	INC HL	16553	35			4214
	JR STASH	16554	24	236		4474
READ						
STRING	LD HL,(E-LINE)	16556	42	20	64	4600
	DEC HL	16559	43			4643
	PUSH HL	16560	229			4872
	DEC HL	16561	43			4915
	DEC HL	16562	43			4958
	EX (SP),HL	16563	227			5185
LOOP	PUSH HL	16564	229			5414
	CALL READ					
	CHARACTER	16565	205	159	64	5842
	POP HL	16568	225			6067
	LD B,CODE","	16569	6	26		6099
	CP B	16571	184			6283
COMA DONE	JR Z,DONE	16572	40	13		6336
	LD (HL),A	16574	119			6455
	INC HL	16575	35			6490
INC LEN$	EX (SP),HL	16576	227			6717
	INC (HL)	16577	52			6769
	JR NZ,NO CARRY	16578	32	3		6804
	INC HL	16580	35			6839
	INC (HL)	16581	52			6891
	DEC HL	16582	43			6934
NO CARRY	EX (SP),HL	16583	227			7161
DO MORE	AND A	16584	167			7328
	JR NC,LOOP	16585	48	233		7609
DONE	EX (SP),HL	16587	227			7836
	POP HL	16588	225			8061
	NOP	16589	0			8061
	JP ROM	16590	195	157	20	8433

Figure 3. FREE MEMORY Routine.

Assembly	Listing	Address	Machine	Code		Checksum
FREE MEM	LD HL, (STKEND)	16593	42	28	64	8567
	LD B,H	16596	68			8635
	LD C,L	16597	77			8712
	LD HL,0	16598	33	0	0	8745
	ADD HL,SP	16601	57			8802
	CP A	16602	191			8993
	SBC HL,BC	16603	237	66		9296
	LD B,H	16605	68			9364
	LD C,L	16606	77			9441
	RET	16607	201			9642

Listing 4.

```
  1 SAVE "LISTING 4"
  2 LPRINT "LISTING 4";;;;"USE
FIRST TWO LINES ONLY WITH EXPANS
ION MEMORY";;;;"GRAPHICS KEYS IN
 LINE 30:5374TY5T55885E4W64261YT
56";;;
  3 LLIST 10
  4 LPRINT " SLOW ";;;" GOTO 0"
  5 STOP
 10 POKE 16389,68
 20 CLS
 30 PRINT AT VAL "9",VAL "2";"
";AT VAL "10",VAL "2"
";AT VAL "11",VAL
"2";"
 40 FOR Z=NOT PI TO CODE "+"
 50 UNPLOT Z+Z,Z
 55 UNPLOT Z+Z+SGN PI,CODE "F"-
Z
 60 NEXT Z
 63 RAND USR IV
 70 GOTO CODE "Z"
```

Listing 5.

```
  1 SAVE "LISTING 5"
  2 LPRINT "LISTING 5";;;;
  3 LLIST 10
  4 LPRINT " GOTO 0"
  5 STOP
 10 POKE 16389,255
 20 CLS
 30 SLOW
 40 RAND USR IV
 50 FOR A=1 TO 30
 60 NEXT A
 70 GOTO 40
```

Listing 6.

```
  1 SAVE "LISTING 6"
  2 LPRINT "LISTING 6";;;;
  3 LLIST 10
  4 LPRINT " SLOW ";;;" GOTO 0"
  5 STOP
 10 FOR Z=NOT PI TO CODE "("
 20 PRINT TAB CODE "S"
 30 NEXT Z
 40 RAND USR IV
 50 GOTO CODE "A"
```

Listing 7.

```
  1 SAVE "LISTING 7"
  2 LPRINT "LISTING 7";;;;
  3 LLIST 10
  4 LPRINT " GOTO 0"
  5 STOP
 10 REM JOHN,752-5106,MIKE,752-
5379,CRUMP,895-4809,
 20 PRINT " INPUT NAME"
 30 INPUT A$
 40 RAND USR RS
 50 LET B$=""
 60 RAND USR RD
 70 IF B$="DATA OUT" THEN GOTO
VAL "20"
 80 LET C$=""
 90 RAND USR RD
100 IF B$<>A$ THEN GOTO VAL "50
"
110 PRINT C$
120 GOTO VAL "20"
130 REM DATA OUT,
```

Figure 4. INSTANT REVERSE Routine.

	Assembly Listing	Address	Machine Code			Checksum
IV	LD HL,(D-FILE)	16608	42	12	64	9760
	LD B,H	16611	68			9828
	LD C,L	16612	77			9905
	LD D,59	16613	22	59		9986
	SLA D	16615	203	34		10223
LOOP	LD HL,(VARS)	16617	42	16	64	10345
	LD A,(BC)	16620	10			10355
	CP D	16621	186			10541
	JR Z,AGAIN	16622	40	3		10584
	ADD A,128	16624	198	128		10910
	LD (BC),A	16626	2			10912
AGAIN	INC BC	16627	3			10915
	CP A	16628	191			11106
	SBC HL,BC	16629	237	66		11409
	JR NZ,LOOP	16631	32	240		11681
	RET	16633	201			11882

Figure 5. RELOCATION Routine.

	Assembly Listing	Address	Machine Code			Checksum
RELOCATE	LD HL,(RAMTOP)	16634	42	4	64	11992
	LD BC,-120	16637	1	136	255	12384
	ADD HL,BC	16640	9			12393
	PUSH HL	16641	229			12622
	PUSH HL	16642	229			12851
	EXX	16643	217			13068
	POP BC	16644	193			13261
	EXX	16645	217			13478
	LD HL,16514	16646	33	130	64	13705
	POP DE	16649	209			13914
	LD BC,120	16650	1	120	0	14035
	LDIR	16653	237	176		14448
	EXX	16655	217			14665
	DEC BC	16656	11			14676
	OUT 253,A	16657	211	253		15140
	JP NEW	16659	195	203	3	15541

Listing 8.

```
  1 SAVE "LISTING 8"
  2 LPRINT "LISTING 8";;;;
  3 LLIST 10
  4 LPRINT " GOTO 0"
  5 STOP
 10 LET F=SGN PI
 20 GOSUB CODE " COPY "
 25 IF F THEN PRINT "FUNCTION"
 30 INPUT A$
 35 IF F THEN PRINT "LOWER LIMI
T"
 40 INPUT X
 45 IF F THEN PRINT "UPPER LIMI
T"
 50 INPUT A
 60 LET K=X
 70 FAST
 80 IF F THEN CLS
 85 LET F=NOT PI
 90 LET DX=(A-X)/CODE "Z"
100 LET H=VAL A$
110 LET L=H
120 FOR I=NOT PI TO CODE "Z"
130 IF H<VAL A$ THEN LET H=VAL
A$
140 IF L>VAL A$ THEN LET L=VAL
A$
150 LET X=X+DX
160 NEXT I
170 LET X=K
180 SLOW
190 FOR I=NOT PI TO CODE "Z"
200 PLOT I,VAL "43"*(VAL A$-L)/
(H-L)
210 LET X=X+DX
220 NEXT I
230 GOSUB VAL "400"
240 GOTO VAL "30"
300 RAND USR RS
310 FOR A=VAL "-2" TO VAL "10"
320 FOR B=NOT PI TO VAL "24" ST
EP VAL "8"
330 LET A$=""
340 IF B OR A<NOT PI THEN RAND
USR RD
350 IF NOT B AND A>-SGN PI THEN
LET A$=STR$ A
360 PRINT TAB B;A$;
370 NEXT B
380 NEXT A
390 REM ***,SELECT,OPTION,***,O
PTION,FN,RANGE,, INPUT ,YOUR,OWN
FN,
400 INPUT B
420 IF NOT B THEN RETURN
430 RAND USR RS
440 FOR A=SGN PI TO VAL "3*B+8"
450 LET A$=""
460 RAND USR RD
470 NEXT A
480 FOR A=-SGN PI TO SGN PI
491 LET B$=""
500 RAND USR RD
510 IF A<NOT PI THEN LET A$=B$
520 IF NOT A THEN LET X=VAL B$
530 NEXT A
540 LET A=VAL B$
550 GOTO VAL "60"
1000 REM SIN X,0,2*PI,COS X,0,2*
PI,TAN X,-1,1,SIN X+SIN (2*X)+SI
N (3*X),0,4*PI,ASN X,-1,1,LN X,,
1,2.7,EXP X,-1,1,ABS (X-INT X-.5
),0,3,1/X,,1,2,EXP -(X*X),-2,2,
```

lower and upper limit. If you only have 1K RAM then you will not be able to use this feature. If this is the case, then enter the program without the USR routines in memory and omit lines 10, 20, 25, 35, 45, 80, 230, 300, and every line above 300.

You cannot plot more than one function on the screen at the same time, but none of the prompt messages will appear after the first graph. Prompt messages also do not appear on the 1K version described above.

I hope that these routines and programs are of use to you. If you have other ideas on how to extend the capabilities of this little computer in this way, drop a line to *SYNC*. ■

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Quick-draw! *Harry Doakes*

More than two years ago, Sinclair announced that the 4K ROM of the ZX80 would be expanded to an 8K ROM and that one of the new commands would be DRAW. DRAW was just what it sounded like—a command to draw a line on the TV screen.

But DRAW never came to be. Even an 8K ROM has only so much room, and DRAW would not quite fit. There is a routine to do the same thing in the ZX81 and TS1000 manuals—but it is in Basic, and it is *slow*.

If you have been following this series of articles on programming in machine code, you have already learned how to translate many Basic commands into machine code. This time, we will look at two new instructions, and then see how they can be used in the machine code translation of that line-drawing routine. We will also look at numbers in base 16—the mysterious "hex" numbers—and see why they are handy for machine code programming.

Most machine code listings are in hex; hex numbers save space each has exactly two digits.

Negative Thinking

You already know that each regular register in the Z80 microprocessor, like each byte of memory, can hold any number between 0 and 255. Sometimes, though, we want to keep track of a *negative* number—a number that is less than zero.

Fortunately, there is an easy way to do it. Suppose register A contains the number 255—the highest number it can hold. Now suppose the next instruction in the Z80 program is

```
INC A
```

In Basic, this would be

```
LET A=A+1
```

What is the number in register A now? It is zero. When a register goes "over the top," it starts all over again at the bottom. It is as if the register automatically subtracts 256 if a number is too high. In other words, when you are using a regular register, 255 + 1 = 0

As you might guess, subtraction works the same way. Once a register hits bottom, it starts over again at the top. In this case, it is as if the register automatically *adds* 256. Thus, 0 - 1 = 255. But that does not help much—or does it?

It turns out that you really *can* use 255 instead of -1. Surprising as it sounds, all the arithmetic works. Consider this example:

```
14+(-1)=13
```

Can we really replace -1 with 255? Here is how it works:

```
14+255=269
```

Since 269 is higher than 255, the register automatically subtracts 256:

```
14+255=269-256=13
```

The arithmetic does work—and that can be a big advantage, as long as we keep track of whether the value in a byte or register is a regular number (between 0 and 255) or a negative number.

More Negative Thinking

Now that we have negative numbers, we can use an instruction that makes a number negative. The instruction

```
NEG
```

will take whatever value is in register A and make it negative. The equivalent in Basic might be

```
LET A=-A
```

That probably seems pretty straightforward—but there is a catch. Remember, we have to keep track of which numbers may be negative. For example, if the value in register A is 1, NEG will change it to -1, or 255. But, if the number in A is 255, NEG will not make it -255. NEG assumes 255 really means -1, so it changes the value to 1.

If this sounds complicated, here is a simple rule: When you are using negative numbers, figure that only the values from 0 to 127 are positive. The other values are negative numbers—from -1 down to -128. That way, you are not likely to lose track of what is negative and what is not.

Great Divide

The Z80 processor can add and subtract pretty well, but it has a tougher time multiplying and dividing. It *can* do one kind of division, though: it can divide by 2. (Maybe that does not seem so great—but it is better than nothing at all.)

The instructions that divide by 2 are called "shift" instructions. Here is why: suppose you divide 142 by 10. The answer is 14.2—which looks a lot like 142. The difference is that the answer has been shifted over one decimal place. The Z80 shift instructions do the same sort of thing, but using base 2 instead of base 10. Dividing by 2 shifts a number over one "binary" place.

Fortunately, we do not have to worry

Harry Doakes, PO Box 10860, Chicago, IL 60610.

much about what a "binary" place might be. When you divide by 2, the answer is the same in binary or in decimal.

There are two different divide-by-2 instructions—one for numbers you know are positive (0 to 255) and one for numbers that might be negative (-128 to 127).

The first is the "shift to the right logically" instruction, abbreviated SRL. For this instruction, the Z80 assumes that the value in the register is a positive number and divides it by 2. For example, suppose register B contains 15. After the instruction

SRL B

register B will have the value 7—which is the next whole number less than 15/2.

For numbers that might be negative, you can use the "shift to the right arithmetically" instruction. If B is -15, then after

SRA B

This will equal -8, which is the next whole number less than -15/2.

Notice that it is always the next number *lower*, not closer to zero. It is exactly the same as the INT function in 8K Basic, though not the same as integer arithmetic in 4K Basic.

Why is one kind of shift called "logically" and the other "arithmetically"? It is jargon, that is all—and it is only mentioned here because those initials are used in the abbreviations SRL and SRA.

You can use these "divide-by-2" instructions with any of the regular registers: A, B, C, D, E, H, or L. You can also use register pair HL as a pointer, with the instructions

SRL (HL)

and

SRA (HL)

Doubling Up

If you can "shift to the right" to divide, can you "shift to the left" to multiply? Certainly. If register D equals 45, then after

SLA D

D will equal 90. The SLA instruction works with all the regular registers, and with positive or negative numbers. But remember, you may get something you do not expect if the result is outside the right range.

Drawing the Line

Now let's look at the routine that draws a line. Listing 1 is a slightly modified version of a program in the "Graphics" chapter of the ZX81 or TS1000 manual.

It is designed to work as a subroutine in Basic. To draw a line from one point on the screen to another, you use LET statements to make XSTART and YSTART equal the starting coordinates of the line, and XEND and YEND the ending coordinates; then you simply

Listing 1.

```
1000 LET U=XEND-XSTART
1010 LET M=ABS(U)
1020 LET X1=SGN(U)
1030 LET X2=X1
1040 LET V=YEND-YSTART
1050 LET N=ABS(V)
1060 LET Y1=SGN(V)
1070 LET Y2=Y1
1080 IF M>N THEN GOTO 1140
1090 LET U=N
1100 LET N=M
1110 LET M=U
1120 LET X2=0
1130 GOTO 1150
1140 LET Y2=0
1150 LET S=INT(M/2)
1160 FOR I=0 TO M
1170 PRINT AT YSTART,XSTART;CHR$
(128);
1180 LET S=S+N
1190 LET XQ=X2
1200 LET YQ=Y2
1210 IF S<M THEN GOTO 1250
1220 LET S=S-M
1230 LET XQ=X1
1240 LET YQ=Y1
1250 LET XSTART=XSTART+XQ
1260 LET YSTART=YSTART+YQ
1270 NEXT I
1280 LET XSTART=XEND
1290 LET YSTART=YEND
1300 RETURN
```

GOSUB 1000. When it is finished drawing, the old ending coordinates become the new starting coordinates.

For example, to draw a triangle whose three corners are at coordinates (1,2), (3,8), and (10,5), you could do this:

```
10 LET XSTART=1
20 LET YSTART=2
30 LET XEND=3
40 LET YEND=8
50 GOSUB 1000
60 LET XEND=10
70 LET YEND=5
80 GOSUB 1000
90 LET XEND=1
100 LET YEND=2
110 GOSUB 1000
```

If you have the 4K ROM, you will not be able to run the Basic program. There is no PRINT AT command in integer Basic. And, if you have only 1K RAM, you probably will not have enough memory. That is because the display file, where the picture sent to your TV screen is stored, can take up as much as 729 bytes—nearly 3/4K.

Parlez-vous Z80?

Translating the line-drawing routine into Z80 machine code is generally pretty straightforward. Figure 1 shows the translation for a computer with 2K RAM. For

Figure 1. Basic and Machine Code Versions of Listing 1.

```
1000 LET U=XEND-XSTART

3A F4 47          LD A,(XSTART)   ;start by subtracting
                                   XEND-XSTART
47                LD B,A
3A F6 47          LD A,(XEND)
90                SUB A,B         ;now A=U; the flags are set
.....................................................................
1010 LET M=ABS(U)
1020 LET X1=SGN(U)
1030 LET X2=X1

16 01             LD D,1          ;D=X1=SGN(U);
                                   suppose it is a plus..
30 04             JR NC,PLUS1     ;if A-B is positive, then M=A,
                                   X1=1
ED 44             NEG             ;if it is negative, M=-A...
16 FF             LD D,-1         ;...and X1=-1
20 02     PLUS1:  JR NZ,SKIP1     ;finally, if A-B=0...
16 00             LD D,0          ;...then X1=0
67        SKIP1:  LD H,A          ;now H=M; D=X1 (and X2)
7A                LD A,D          ;let's store X1 now
32 FA 47          LD (X1),A
.....................................................................
1040 LET V=YEND-YSTART

3A F5 47          LD A,(YSTART)   ;now do the same thing, except
47                LD B,A          ;with L=N; E=Y1 (and Y2)
3A F7 47          LD A,(YEND)
90                SUB A,B
.....................................................................
1050 LET N=ABS(V)
1060 LET Y1=SGN(V)
1070 LET Y2=Y1

1E 01             LD E,1
30 04             JR NC,PLUS2
ED 44             NEG
```

most program lines each Basic statement becomes a short series of machine code instructions. The most complicated of them is the machine code version of PRINT AT.

But at the very beginning, you will see ABS and SGN, a pair of Basic functions we have not translated into machine code before. Let's take a quick look at how our machine code version of ABS and SGN works.

ABS is the *absolute value* function in Basic. Simply put, it means this:

If X is positive, then ABS(X)=X
If X is negative, then ABS(X)=-X
If X is zero, then ABS(X)=0

In other words, you could replace line 1010 in the Basic program with

1010 IF U>0 THEN LET M=U
1012 IF U<0 THEN LET M=-U
1014 IF U=0 THEN LET M=0

SGN is the *sign* function:

If X is positive, SGN(X)=1
If X is negative, SGN(X)=-1
If X is zero, SGN(X)=0

You could replace line 1020 in the Basic program with

1020 IF U>0 THEN LET X1=1
1022 IF U<0 THEN LET X1=-1
1024 IF U=0 THEN LET X1=0

You can see that ABS and SGN work in much the same way. That is why, to shorten our machine code a little bit, we have combined the two functions into one short routine. Here is how it would look in Basic:

1010 LET X1=1
1012 IF U>=0 THEN GOTO 1018
1014 LET U=-U
1016 LET X1=-1
1018 IF U<>0 THEN GOTO 1022
1020 LET X1=0
1022 LET M=U

In machine code, it works like this:

When we subtract XSTART from XEND, the zero flag and the carry flag are either sent up or down. Remember, the zero flag goes up if the result equals zero, and the carry flag goes up if the result of a subtraction is less than zero; otherwise, the flags come down. By checking the flags, we can tell whether the number is positive, negative, or equal to zero.

We start with a guess—maybe the number is positive. The sign will go in register D, so we say

LD D,1

Next, we test our guess. If U is negative, the carry flag is up. Thus, we say

JR NC,PLUS1

that is, jump ahead if it is not negative. PLUS1 is just a dummy name; we will have to figure out later how far the jump really is.

If U is negative, we say

NEG
LD D,-1

That changes the negative number in A

Figure 1. Continued.

```
1E FF            LD E,-1
20 02    PLUS2:  JR NZ,SKIP2
1E 00            LD E,0
6F       SKIP2:  LD L,A          ;now L=N and E=Y1 (and Y2)
7B               LD A,E         ;let's store Y1 now
32 FB 47         LD (Y1),A

1080 IF M>N THEN GOTO 1140

7D               LD A,L         ;compare M and N
BC               CP H
38 06            JR C,MHIGH     ;if M is higher, jump
.....
1090 LET U=N
1100 LET N=M
1110 LET M=U
1120 LET X2=0
1130 GOTO 1150

6C       NHIGH:  LD L,H          ;otherwise, swap M and N
67               LD H,A         ;remember, N was already in A
16 00            LD D,0         ;D=X2
18 02            JR SKIP3
.....
1140 LET Y2=0

1E 00    MHIGH:  LD E,0          ;if M>N then do this; E=Y2
.....
1150 LET S=INT(M/2)

7A       SKIP3:  LD A,D          ;now store the variables
32 FC 47         LD (X2),A
7B               LD A,E
32 FD 47         LD (Y2),A
7D               LD A,L
32 F9 47         LD (N),A
7C               LD A,H
32 F8 47         LD (M),A
CB 2F            SRA A          ;S=M/2
32 FE 47         LD (S),A
.....
1160 FOR I=0 TO M

3E 00            LD A,0         ;start I with 0
32 FF 47         LD (I),A
.....
1170 PRINT AT YSTART,XSTART;CHR$(128);

2A 0C 40 PLOT:   LD HL,(16396)  ;start of the display file
23               INC HL         ;position is 0,0
3A F4 47         LD A,(XSTART)  ;if XSTART>31, do not plot it
FE 20            CP 32
30 14            JR NC,BUMP
5F               LD E,A         ;DE=XSTART
16 00            LD D,0
19               ADD HL,DE      ;position is XSTART,0
3A F5 47         LD A,(YSTART)  ;if YSTART>21, do not plot it
FE 16            CP 22
30 09            JR NC,BUMP
5F               LD E,A         ;DE=YSTART
06 21            LD B,33        ;there are 33 bytes per line
19       LOOP1:  ADD HL,DE      ;add YSTART bytes
05               DEC B
20 FC            JR NZ,LOOP1    ;do it 33 times
36 80            LD (HL),128    ;plot position XSTART,YSTART
.....
1180 LET S=S+N

3A F9 47 BUMP:   LD A,(N)       ;add S+N
47               LD B,A
3A FE 47         LD A,(S)
80               ADD A,B
32 FE 47         LD (S),A       ;store S
4F               LD C,A         ;C=S
```

```
1190 LET XQ=X2
1200 LET YQ=Y2

3A FC 47        LD A,(X2)
57              LD D,A          ;D=XQ
3A FD 47        LD A,(Y2)
5F              LD E,A          ;E=YQ
3A F8 47        LD A,(M)
47              LD B,A          ;B=M
```

```
1210 IF S<M THEN GOTO 1250

79              LD A,C          ;compare M and S
                                 (registers B and C)
B8              CP B
38 0C           JR C,SKIP4      ;if S<M then jump
```

```
1220 LET S=S-M

90              SUB B           ;otherwise, subtract...
32 FE 47        LD (S),A        ;...store S...
```

```
1230 LET XQ=X1
1240 LET YQ=Y1

3A FA 47        LD A,(X1)       ;...replace X2 with X1...
57              LD D,A
3A FB 47        LD A,(Y1)       ;...and Y2 with Y1
5F              LD E,A
```

```
1250 LET XSTART=XSTART+XQ

3A F4 47 SKIP4: LD A,(XSTART)   ;add
82              ADD D
32 F4 47        LD (XSTART),A   ;store XSTART
```

```
1260 LET YSTART=YSTART+YQ

3A F5 47        LD A,(YSTART)   ;add
83              ADD E
32 F5 47        LD (YSTART),A   ;store YSTART
```

```
1270 NEXT I

3A FF 47        LD A,(I)        ;add 1 to I...
3C              INC A
32 FF 47        LD (I),A        ;store I
47              LD B,A
3A F8 47        LD A,(M)        ;M is the limit
B8              CP B
30 9D           JR NC,PLOT      ;if I<M then plot again
```

```
1280 LET XSTART=XEND

3A F6 47        LD A,(XEND)     ;otherwise, update XSTART..
32 F4 47        LD (XSTART),A
```

```
1290 LET YSTART=YEND

3A F7 47        LD A,(YEND)     ;...update YSTART...
32 F5 47        LD (YSTART),A
```

```
1300 RETURN

C9              RET             ;...and that's it!
```

In this 2K RAM version, the variables are stored in the following memory locations:

Decimal	Hex	Variable	Decimal	Hex	Variable
18420	47F4	XSTART	18426	47FA	X1
18421	47F5	YSTART	18427	47FB	Y1
18422	47F6	XEND	18428	47FC	X2
18423	47F7	YEND	18429	47FD	Y2
18424	47F8	M	18430	47FE	S
18425	47F9	N	18431	47FF	I

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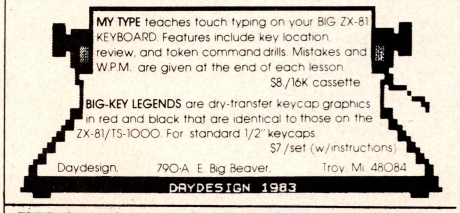

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to a positive value, and makes the sign -1.

Now we are OK if the number is positive or negative. But what if it is zero? The zero flag still tells us whether the result of our subtraction was zero or not. If it is up, we will need to change the sign (in register D) to zero:

```
PLUS1: JR NZ,SKIP1
LD D,0
```

Finally, we will put our absolute value in register H for safekeeping:

```
SKIP1: LD H,A
```

When we are finished, the sign is in register D and the absolute value is in register H.

As usual, translating from Basic to machine code is not really very complicated. Just break the routine down into simple steps—steps that can be performed by something as simple-minded as the Z80 processor—and you are off and running.

Off and Running . . . Almost

When you first looked at Figure 1, you may have noticed a few other things. This is easily the *longest* machine code routine we have tried—200 bytes long, in fact. And in the far left-hand column, where we would normally put each instruction in numerical codes—the version of the program the computer understands-there is a mixture of numbers and letters. What goes on here?

Because this routine is 200 bytes, it is not practical to POKE in the whole program each time you run it. To get around that problem, we will get the computer to do the work. The program in Listing 3 expects its first line to be a REM statement containing the numerical version of a machine language program. It converts the characters in the REM line into values between 0 and 255, and then POKEs them into memory starting at location START.

But instead of decimal numbers, this time the numerical codes are in base 16, or hexadecimal numbers—"hex" numbers for short.

Putting on the Hex

There is a chapter in your ZX81 or TS1000 manual that tells something about hex numbers—it is titled either "Counting" or "Number Systems," depending on which edition you have. It explains how hexadecimal numbers use all the digits from 0 through 9, and the letters A, B, C, D, E, and F as well. If you have not looked at it before, be sure to read it.

But even more important for machine code programming is the "Character Set" appendix. It has all the machine code instructions, along with both the decimal and hex numbers the Z80 processor understands. That makes it very easy to translate a number between decimal and hex—you can just look in the appendix.

Why use hex numbers this time? To save space. Notice that every hex number up to FF (in decimal, 255) can be written with exactly two digits. That means each pair of digits is one number. You can

Listing 2.

8K ROM

```
  10 PRINT "HOW MANY BYTES?"
  20 INPUT A
  30 LET RT=PEEK 16388+256*PEEK
16389
  40 LET RT=RT-A
  50 LET H=INT (RT/256)
  60 LET L=RT-256*H
  70 POKE 16388,L
  80 POKE 16389,H
  90 NEW
```

4K ROM

```
  10 PRINT "HOW MANY BYTES?"
  20 INPUT A
  30 PRINT "HOW MANY K OF RAM DO
 YOU HAVE?"
  40 INPUT RT
  50 LET RT=1024*(RT+16)-A
  60 LET H=RT/256
  70 LET L=RT-256*H
  80 POKE 16428,49
  90 POKE 16429,L
 100 POKE 16430,H
 110 POKE 16431,195
 120 POKE 16432,108
 130 POKE 16433,2
 140 PRINT "YOUR ROUTINE WILL ST
ART AT ";RT
 150 PRINT "PRESS NEWLINE TO RES
ERVE SPACE"
 160 INPUT A$
 170 LET A=USR(16428)
```

cram them together with no space between, and then easily break them up into pairs again. For example, it is easy to see that

```
210000C9
```

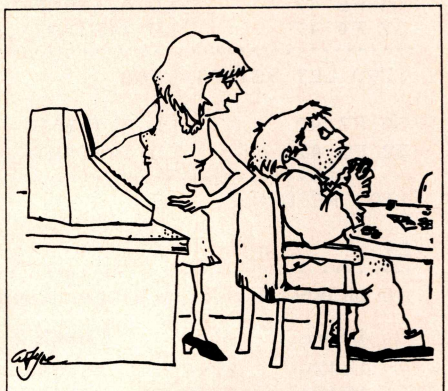
means the same thing as

```
21 00 00 C9
```

You cannot do that with decimal numbers. Some decimal numbers have one digit, some two, and some three. Suppose you left the spaces out of this sequence:

```
6 173 22 2 201
```

If you did not already know what the



"It says the odds of you making that hand are 2,385,000 to 1, and the odds are 3 to 2 that a nut like you will try for it."

original numbers were, you would never be able to re-create the original sequence from

6173222201

Of course, you *could* use zeroes to make each number three digits:

006173022002201

But then our 200-byte routine would fill up a REM line 600 bytes long. That is a lot of memory to take up if you only have 2K. With two-digit hex numbers, it only takes 400 bytes, or two-thirds the space.

There is another advantage to using hex numbers. Most machine code listings

Listing 3.

```
  1 REM 3AF447473AF647901601300
4ED4416FF20021600677A32FA473AF54
7473AF747901E013004ED441EFF20021
E006F7B32FB477DBC38066C671600180
21E007A32FC477B32FD477D32F9477C3
2F847CB2F32FE473E0032FF472A0C402
33AF447FE2030145F1600193AF547FE1
630095F0621190520FC36803AF947473
AFE478032FE474F3AFC47573AFD475F3
AF8474779B8380C9032FE473AFA47573
AFB475F3AF4478232F4473AF5478332F
5473AFF473C32FF47473AF847B8309D3
AF64732F4473AF74732F547C9
 10 LET RSTART=16514
 20 LET START=PEEK 16388+256*PE
EK 16389
 30 LET A=0
 40 LET H=PEEK (RSTART+2*A)-28
 50 IF H<0 OR H>15 THEN STOP
 60 LET L=PEEK (RSTART+2*A+1)-2
8
 70 IF L<0 OR L>15 THEN STOP
 80 LET N=16*H+L
 90 POKE START+A,N
100 LET A=A+1
110 GOTO 40
```

16K RAM Changes

```
  1 REM 3AF47F473AF67F901601300
4ED4416FF20021600677A32FA7F3AF57
F473AF77F901E013004ED441EFF20021
E006F7B32FB7F7DBC38066C671600180
21E007A32FC7F7B32FD7F7D32F97F7C3
2F87FCB2F32FE7F3E0032FF7F2A0C402
33AF47FFE2030145F1600193AF57FFE1
630095F0621190520FC36803AF97F473
AFE7F8032FE7F4F3AFC7F573AFD7F5F3
AF87F4779B8380C9032FE7F3AFA7F573
AFB7F5F3AF47F8232F47F3AF57F8332F
57F3AFF7F3C32FF7F473AF87FB8309D3
AF67F32F47F3AF77F32F57FC9
```

4K ROM Changes

```
 10 LET RSTART=16427
 20 PRINT "START LOCATION?"
 25 INPUT START
```

in magazines and in many of the books on machine code programming are in hex numbers rather than decimal. So once you have the hang of hex, it is much easier to understand those books and articles—and use the machine code programs they describe.

Quick Draw

To use this machine code line-drawing routine, very carefully type in the program in Listing 3. (It is designed for an 8K ROM computer with 2K RAM; be sure to use the alternate REM line if your computer has 16K.) Count the number of characters in the REM line after you have typed it in, to make sure you have not missed any—or better still, check the whole line to make sure it is right.

Now—before you try the program—SAVE it on tape! If you have made a mistake, you will be able to edit just the REM line to correct it, instead of typing the entire program again.

Next, use the program in Listing 2 to save space at the top of memory. For this routine, you should save 212 bytes: 200 for the program, and 12 for the variables.

Listing 4.

```
 10 LET Q=PEEK 16388+256*PEEK
6389
 20 FOR A=1 TO 22*32
 30 PRINT " ";
 40 NEXT A
 50 INPUT XSTART
 60 POKE Q+200,XSTART
 70 INPUT YSTART
 80 POKE Q+201,YSTART
 90 INPUT XEND
100 POKE Q+202,XEND
110 INPUT YEND
120 POKE Q+203,YEND
130 LET A=USR (Q)
140 GOTO 90
```

4K ROM Changes

```
 10 PRINT "START LOCATION?"
 14 INPUT Q
 18 CLS
```

Then LOAD the program you have SAVEd on tape, RUN it, then edit out each of the program lines. Finally, type in and RUN the program in Listing 4. It demonstrates the line-drawing routine. If your computer has SLOW mode, it will leave no doubt how much faster than Basic machine code can be.

Coming Attractions

A machine code routine like this one is fast—but it is also long. Everything the routine does must be included in the program, and sometimes that means "reinventing the wheel." After all, there are already machine code routines for printing on the screen, plotting points, and many other functions already in your computer—stored in the ROM.

Next time, we will see how to put those routines—the "ROM calls"—to work. We will also learn about writing our own subroutines, when there is nothing in ROM that does exactly what we want. And we will take a look at the "stack," and some of the special features of the Sinclair computers.

If you have comments or questions about machine code programming, or something is not quite clear, let me hear from you. Be sure to send along a stamped, self-addressed envelope if you need a reply.

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The ZX Stock Exchange

Donald A. Burgio

You have just inherited $10,000 from a wealthy uncle who made it big on the stock market. He also gave you the modem number of his broker, a computer.

The ZX Stock Exchange carries stocks listed on the New York Stock Exchange as well as stocks not listed there. For the purpose of demonstrating how the market works, a random selection of stocks of five stocks has been made and entered as three letter abbreviations: AAA, BBB, CCC, DDD, EEE. When you enter the program, you may substitute the stocks that you believe have the greatest optential. However, you must use designations of three letters. You must also put in the full name of each in lines 890, 920, 950, 980, and 1010.

The stock prices are generated somewhat randomly, but they show short and long term trends just as on other stock exchanges. To get the "feel" of the market, the program should be played for at least 10 market days.

Donald A. Burgio, 20 Oak Rd., Congers, NY 10920.

Your broker the computer charges you a modest one percent brokerage fee on all transactions made.

Getting Started

First, carefully type in the program in Listing 1. Save it by typing GOTO 2760. This will cause it to run automatically after LOADing.

When the program is running, the first thing the computer will ask is whether or not you want instructions. Regardless of whether you get instructions, press S to begin.

Figure 1 shows the initial printing of the stock: the name, initials, price per share. Your stock, cash, and total assets will then be briefly shown.

Next the computer will ask you for your transaction for each stock. To buy, type xxx, where xxx is the number of shares you want to buy. If you do not want to buy or sell, type 0.

After you have entered your initial transactions, the screen format will look like Figure 2. At the top will be displayed how many days you have been playing. Then a chart will show the stock initials, price per share, your holdings (the number of shares in your portfolio), the total value of the stocks, and the change from the previous day. The next lines will be any messages, the ZX Stock Exchange average, the net change, and the value of your stock, cash, and total assets. You will then be asked whether you want to continue. Type Y for yes and N for no.

Program Description

Lines 10-120 and 230-830 initialize the program and give instructions if requested.

The subroutine in lines 130-220 is frequently used for formatting. A cash value such as 23.6 is inputted as G. The subroutine will then manipulate G so that it comes out as a neater form stored in R$, 23.60 in the example. The length of R$ is stored in L for neatness by lining up the decimal points on the cash amounts.

Line 190 takes care of a peculiar happening on the ZX81 which is due to the nature of floating point arithmetic. E.g., type PRINT 1012.56-INT 1012.56 or PRINT 1012.56-1012. The computer should print .56, but instead it prints

Figure 1.

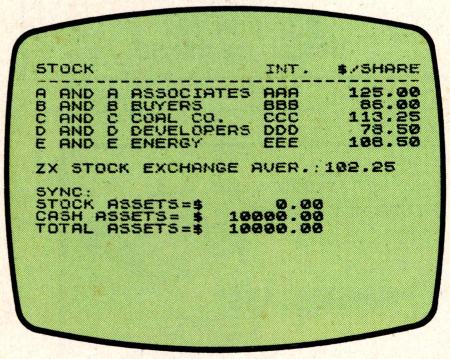


Figure 2.

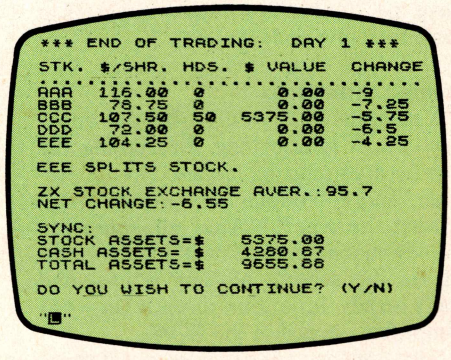
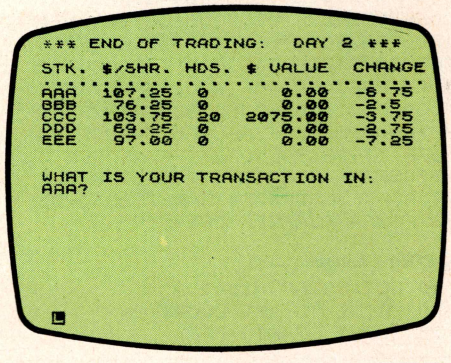


Figure 3.



0.55999994. This happens with a few other numbers also, and it must be accounted for in software.

Lines 840-1010 set up the initial display shown in Figure 1. Lines 1012-1180 calculate the stock exchange average (EA) and net change (NC). Lines 1190-1320 print your stock assets (SA), cash assets (C), and total assets (D).

Listing 1. The ZX Stock Exchange.

```
  10 REM STOCK MARKET SIMULATION
  20 REM BY DONALD A. BURGIO/20
OAK ROAD/CONGERS, NY 10920
  30 DIM I$(5,3)
  40 DIM O$(2)
  50 LET A$="INT (RND*4.99)+1"
  60 LET I$(1)="AAA"
  70 LET I$(2)="BBB"
  80 LET I$(3)="CCC"
  90 LET I$(4)="DDD"
 100 LET I$(5)="EEE"
 110 RAND
 120 GOTO 230
 130 LET X=ABS G
 140 LET B=INT X
 150 LET E=X-B
 160 LET Z$=STR$ B
 170 IF E=0 THEN LET O$="00"
 180 IF E<>0 THEN LET O$=STR$ (1
00*E)
 190 IF O$(2)="." THEN LET O$=ST
R$ ((1000*E)+.01)
 200 LET R$=Z$+"."+O$
 210 LET L=LEN R$
 220 RETURN
 230 LET A=INT ((RND/10)*100+.5)
/100
 240 DIM S(5)
 250 DIM P(5)
 260 DIM T(5)
 270 DIM C(5)
 280 LET TT=0
 290 LET F=0
 300 LET D1=0
 310 LET D2=0
 320 LET P=0
 330 LET P2=0
 340 LET DY=0
 350 LET EA=0
 360 SLOW
 370 CLS
 380 FOR I=1 TO 20
 390 PRINT AT 0,0;"
                    THE ZX
STOCK EXCHANGE
 400 PRINT AT 0,0;"
                    THE ZX
STOCK EXCHANGE
 410 NEXT I
 420 PRINT AT 3,0;"WHAT IS YOUR
NAME?"
 430 INPUT N$
 440 PRINT AT 3,0;"DO YOU WANT I
NSTRUCTIONS? (Y/N)"
 450 INPUT Z$
 460 IF Z$="N" THEN PRINT AT 3,0
;"
 470 IF Z$="N" THEN GOTO 680
 480 CLS
 490 PRINT "WELCOME TO THE ZX ST
OCK EXCHANGE"
 500 PRINT TAB ((33-LEN N$)/2);N
$+"."
 510 PRINT "YOUR ACCOUNT CURRENT
LY CONTAINS"
 520 PRINT "$10,000.  YOU MAY BU
Y OR SELL"
 530 PRINT "STOCKS.  A TABLE OF
AVAILABLE "
 540 PRINT "STOCK, THEIR PRICES,
 AND THE"
 550 PRINT "NUMBER OF SHARES IN
YOUR PORT-"
 560 PRINT "FOLIO WILL BE PRINTE
D.  FOLLOW-"
 570 PRINT "ING THIS THE INTITIA
LS OF EACH"
 580 PRINT "STOCK WILL BE PRINTE
D.  HERE YOU"
 590 PRINT "INDICATE A TRANSACTI
ON.  TO BUY"
 600 PRINT "A STOCK TYPE XXX, WH
ERE XXX IS "
 610 PRINT "THE NUMBER OF SHARES
 YOU WISH TO"
 620 PRINT "BUY.  TO SELL TYPE -
XXX, WHERE"
 630 PRINT "-XXX IS THE NUMBER O
F SHARES YOU"
 640 PRINT "WISH TO SELL.  A 1 P
ERCENT BRO-"
 650 PRINT "KERAGE FEE WILL AUTO
MATICALLY"
 660 PRINT "BE CHARGED TO YOUR A
CCOUNT."
 670 PRINT TAB 11;"GOOD LUCK."
 680 LET S(1)=130
 690 LET S(2)=90
 700 LET S(3)=120
 710 LET S(4)=85
 720 LET S(5)=115
 730 LET TR=VAL A$
 740 PRINT AT 21,7;"PRESS S TO S
TART."
 750 IF INKEY$="S" THEN GOTO 790
 760 PRINT AT 0,0;"
                    THE ZX
STOCK EXCHANGE"
 770 PRINT AT 0,0;"WELCOME TO TH
E ZX STOCK EXCHANGE"
 780 GOTO 750
 790 IF RND>.5 THEN GOTO 810
```

Continued

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Listing 1. Continued.

```
 800 LET A=-A
 810 CLS
 820 GOSUB 2010
 830 LET C=10000
 840 PRINT
 850 PRINT "STOCK                    I
NT    $/SHARE"
 860 PRINT "--------------------
-----------"

 870 LET G=S(1)
 880 GOSUB 130
 890 PRINT "A AND A ASSOCIATES A
AA ";TAB (32-L);R$
 900 LET G=S(2)
 910 GOSUB 130
 920 PRINT "B AND B BUYERS       B
BB ";TAB (32-L);R$
 930 LET G=S(3)
 940 GOSUB 130
 950 PRINT "C AND C COAL CO.     C
CC ";TAB (32-L);R$
 960 LET G=S(4)
 970 GOSUB 130
 980 PRINT "D AND D DEVELOPERS D
DD ";TAB (32-L);R$
 990 LET G=S(5)
1000 GOSUB 130
1010 PRINT "E AND E ENERGY      E
EE ";TAB (32-L);R$

1020 LET TA=EA
1030 LET EA=0
1040 LET SA=0
1050 FOR I=1 TO 5
1060 LET EA=EA+S(I)
1070 LET SA=SA+S(I)*P(I)
1080 NEXT I
1090 LET EA=INT ((100*(EA/5)+.5)/
100
1100 LET NC=INT ((EA-TA)*100+.5)
/100
1110 LET D=SA+C
1120 IF F THEN GOTO 1160
1130 PRINT
1140 PRINT "ZX STOCK EXCHANGE AV
ER.:";EA
1150 GOTO 1190
1160 PRINT
1170 PRINT "ZX STOCK EXCHANGE AV
ER.:";EA
1180 PRINT "NET CHANGE:";NC
1190 PRINT
1200 PRINT N$;":"
1210 LET SA=INT (100*SA+.5)/100
1220 LET G=SA
1230 GOSUB 130
1240 PRINT "STOCK ASSETS=$";TAB
(24-L);R$
1250 LET C=INT (100*C+.5)/100
1260 LET G=C
1270 GOSUB 130
1280 PRINT "CASH ASSETS= $";TAB
(24-L);R$
1290 LET D=INT (100*D+.5)/100
1300 LET G=D
1310 GOSUB 130
1320 PRINT "TOTAL ASSETS=$";TAB
(24-L);R$
1330 PRINT
1340 IF NOT F THEN PAUSE 225
1350 IF NOT F THEN POKE 16437,25
5

1360 IF NOT F THEN GOTO 1400
1370 PRINT "DO YOU WISH TO CONTI
NUE? (Y/N)"
1380 INPUT C$
1390 IF C$="N" THEN GOTO 2510
1400 FOR I=10 TO 21
1410 PRINT AT I,0;"

1420 NEXT I
1430 PRINT AT 11,0;"WHAT IS YOUR
 TRANSACTION IN:"
1440 FOR I=1 TO 5
1450 PRINT AT 12,0;I$(I);"?"
1460 INPUT T(I)
1470 NEXT I
1480 PRINT AT 20,0;"PLEASE WAIT.
.."
1490 LET DP=0
1500 LET DS=0
1510 FOR I=1 TO 5
1520 LET T(I)=INT (T(I)+.5)
1530 IF T(I)<=0 THEN GOTO 1560
1540 LET DP=DP+T(I)*S(I)
1550 GOTO 1620
1560 LET DS=DS-T(I)*S(I)
1570 IF -T(I)<=P(I) THEN GOTO 16
20

1580 PRINT AT 20,0;"YOU HAVE OVE
RSOLD A STOCK; TRY  AGAIN.  "
1590 PAUSE 300
1600 POKE 16437,255
1610 GOTO 1400
1620 NEXT I
1630 LET TT=DP+DS
1640 LET BF=INT (.01*TT*100+.5)/
100
1650 LET CT=C-DP-BF+DS
1660 IF CT>=0 THEN GOTO 1720
1670 PRINT AT 19,0;"YOU HAVE TRI
ED TO SPEND "
1680 PRINT "$";-CT;" MORE THAN Y
OU HAVE."
1690 PAUSE 300
1700 POKE 16437,255
1710 GOTO 1400
1720 LET C=CT
1730 FOR I=1 TO 5
1740 LET P(I)=P(I)+T(I)
1750 NEXT I
1760 CLS
1770 GOSUB 2010
1780 LET DY=DY+1

1790 PRINT "*** END OF TRADING:
 DAY ";DY;" ***"
1800 PRINT
1810 PRINT "STK.  $/SHR.  HDS.  $ V
ALUE   CHANGE"
1820 PRINT "-----------------
-----------"
1830 FOR I=1 TO 5
1840 LET G=S(I)
1850 GOSUB 130
1860 PRINT AT 3+I,0;I$(I);AT 3+I
,(11-L);R$;AT 3+I,13;P(I);
1870 LET G=S(I)*P(I)
1880 GOSUB 130
1890 PRINT AT 3+I,(24-L);R$;AT 3
+I,26;C(I)
1900 NEXT I
1910 LET F=1
1920 PRINT
1930 LET R=VAL ((STR$ RND)(1 TO
4))
1940 LET I=INT (RND*7)
1945 IF I>5 THEN GOTO 1940
1950 IF I=0 THEN GOTO 1940
1960 IF R<.15 THEN PRINT I$(I);"
 DECLARES DIVIDENTS OF $";(R*4+.
5);"/SHARE."
1970 IF R<.15 THEN LET C=C+P(I)*
(R*4+.5)
1980 IF R>.93 THEN PRINT I$(I);"
 SPLITS STOCK."
1990 IF R>.93 THEN LET P(I)=P(I)
*2
2000 GOTO 1020
2010 FAST
2020 IF D1>0 THEN GOTO 2050
2030 LET S=VAL A$
2040 LET D1=VAL A$
2050 LET P=1
2060 IF D2>0 THEN GOTO 2100
2070 LET S2=VAL A$
2080 LET D2=VAL A$
2090 LET P2=1
2100 LET D1=D1-1
2110 LET D2=D2-1
2120 FOR I=1 TO 5
2130 LET R=RND
2140 IF R>.25 THEN GOTO 2170
2150 LET R=.25
2160 GOTO 2240
2170 IF R>.5 THEN GOTO 2200
2180 LET R=.5
2190 GOTO 2240
2200 IF R>.75 THEN GOTO 2230
2210 LET R=.75
2220 GOTO 2240
2230 LET R=0
2240 LET BC=0
2250 IF P<1 THEN GOTO 2290
2260 IF INT (S+.5)<>INT (I+.5) T
HEN GOTO 2290
2270 LET BC=4
2280 LET P=0
2290 IF P2<1 THEN GOTO 2330
2300 IF INT (S2+.5)<>INT (I+.5)
THEN GOTO 2330
2310 LET BC=-4
2320 LET P2=0
2330 LET C(I)=INT (A*S(I))+R+INT
 (3-6*RND+.5)+BC
2340 LET C(I)=INT (100*C(I)+.5)/
100
2350 LET S(I)=S(I)+C(I)
2360 IF S(I)>0 THEN GOTO 2400
2370 LET C(I)=0
2380 LET S(I)=0
2390 GOTO 2410
2400 LET S(I)=INT (100*S(I)+.5)/
100
2410 NEXT I
2420 LET TR=TR-1
2430 IF TR<1 THEN GOSUB 2460
2440 SLOW
2450 RETURN
2460 LET TR=VAL A$
2470 LET A=INT ((RND/10)*100+.5)
/100
2480 IF RND<=.5 THEN GOTO 2500
2490 LET A=-A
2500 RETURN
2510 CLS
2520 PRINT
2530 PRINT
2540 PRINT "AT THE END OF ";DY;"
 DAYS TRADING:"
2550 IF D>=10000 THEN GOTO 2610
2560 PRINT "YOU HAVE LOST $";
2570 LET G=10000-D
2580 GOSUB 130
2590 PRINT R$
2600 GOTO 2650
2610 PRINT "YOU HAVE MADE $";
2620 LET G=D-10000
2630 GOSUB 130
2640 PRINT R$
2650 PRINT "ON THE ZX STOCK EXCH
ANGE."
2660 PRINT
2670 PRINT "HOPE YOU HAD FUN, ";
N$;"."
2680 PRINT "COME BACK AGAIN."
2690 PRINT AT 20,2;"PRESS S TO R
ETURN TO BASIC."
2700 PRINT AT 0,0;"$$$$$$$$$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
2710 PRINT AT 0,0;"$$$$$$$$$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
2720 PRINT AT 21,0;"$$$$$$$$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
2730 IF INKEY$="S" THEN STOP
2740 PRINT AT 21,0;"$$$$$$$$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
2750 GOTO 2700
2760 CLEAR
2770 SAVE "STOCK"
2780 RUN
```

Figure 4. List of Variables.

Variable	Function
A$	the function INT (RND*4.99)+1
A	trend slope + sign
B	formatting: INT X (dollar amount)
BC	big change constant (-4,0,4)
BF	brokerage fee
C	cash assets
CT	cash total (temporary)
C(I)*	change in stock value
D	total assets
DY	current simulation day
DP	total day's purchases
DS	total day's sales
D1	SPS**
D2	SPS**
E	formatting: Cents amount
EA	exchange average
F	0 = first simulation day
G	formatting: initial cash amount
I$(I)*	Stock initials
L	length of R$ (for lining up decimal points)
N$	user's name
NC	net change
O$	formatting: the final cents amount
P	SPS**
P2	SPS**
P(I)*	number of shares in user's portfolio
R$	final formatted cash amount
R	random value
S	SPS**
SA	stock assets
S2	SPS**
S(I)*	stock values
TA	total assets
TT	total transaction amount
TR	number of days in the trend
T(I)*	transaction amount
X	formatting: ABS G
Z$	formatting: STR$ B, general input

*I *2 = BBB *4 = DDD
*1 = AAA *3 = CCC *5 = EEE ** Stock price subroutine; see text.

Lines 1330-1470 ask if you want to continue. If the answer is Y (yes), the program then asks you to input your transactions.

Lines 1480-1750 make sure that you have not spent more than you have and that you do not try to sell more stock than you own. The brokerage fee (BF) is calculated at line 1640.

Lines 1760-2000 set up the screen display similar to Figure 2. Lines 1940-1990 randomly split stocks (i.e., doubles the number of shares you presently have) and declares dividends.

The subroutine that makes the stock prices is located in lines 2010-2500. D1 and D2 are random numbers of days which respectively determine when stock S will increase 4 points and when stock S2 will decrease 4 points. If D1 days have passed, it picks a stock (S), sets P, and determines a new D1. This is done similarly with D2, S2, and P2. If D1 or D2 days have not passed, the change is determined using the trend sign and slope (A), which is changed after TR days, and a random amount (R) less than $1.

The conclusion is contained in lines 2510-2750. Lines 2760-2780 save the program so that it RUNs automatically after LOADing.

For the benefit of those who are interested in programming techniques (and for those who want to "fix the game to their advantage," a euphemmistic phrase for "cheating"), a list of the variables is found in Figure 4.

Line notes:

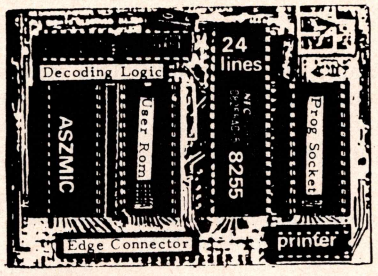
390: G (6), THE ZX STOCK EXCHANGE in inverse, G (5).

400: F (6), THE ZX STOCK EXCHANGE in normal letters, F (5).

760: WELCOME TO THE ZX STOCK EXCHANGE in inverse.

2700 and 2720: Inverse $ (32).

ZX81 MACHINE CODE?



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CIRCLE 13 ON READER SERVICE CARD

Using the Byte-Back Modem

Tom Keeney

Introduction

Since buying my Sinclair ZX80, I have made so many changes that it is hardly recognizable. One of the most satisfying has been the addition of an RS232 interface and a modem.

I have had a longstanding and probably irrational interest in data communications. Exchanging data between machines opens up the prospect of electronic mail and banking. The individual can also access large data bases such as Compuserve, Dow Jones, and "The Source." I find this an exciting look at what I hope will be the future.

All that is needed is a device called a *modem.* It is available from Radio Shack for about $150. Unfortunately, most modems will not work on a Sinclair because they require something called an RS232 interface.

The Byte-Back Modem

When I saw that the Byte-Back Co. was offering a modem that would attach directly to the Sinclair, I wasted a few milliseconds in debate and then ordered one. I was even more pleased when I learned that not only did the system include an RS232 interface, but that its services were available to me for other purposes.

The Byte-Back modem is a fine device. It works well and actually does more than advertised. The instruction manual, on the other hand, in its attempt to furnish operating instructions, assembly instructions, and engineering data, is a bit sketchy. A description of the non-standard output on the RS232 board is not given nor is there much in the way of checkout procedures.

This article attempts to provide some of that missing information as well as to give a review of my experience with the product. I also recommend V. B. Rice's fine article which describes his homebrew RS232 interface as a source of additional information on the subject (*SYNC* 2:6).

Bytes, Bits, and BAUDs

Before useful information can be exchanged, a common communications mode must be established to satisfy the needs of the communications media. This is the function performed by the modem, its interface, and the associated software.

First, it is necessary to transform the internal character set used by the Sinclair into the ASCII character set used by everyone else. Since the system must both transmit and receive, this transformation must go both ways. Character transformation and control of the interface hardware is the function of the software.

When the data is organized into ASCII codes on the Sinclair data bus, the data must be communicated to the modem. This is the function of the interface. An interface is required because the data on the Sinclair edge connector is arranged on eight parallel wires while the telephone uses only one. This means that the computer can operate on eight signals or bits at once forming a byte. The telephone system, on the other hand, must take those bits one at a time. It is necessary to trade space for time by arranging the data bytes into some agreed upon serial order. It is also necessary for the interface to control the serial transmission rate or BAUD rate. This conversion from parallel to serial is old hat for the Sinclair since that is the method it uses to generate a TV picture and write to the cassette.

The problem is that the TV and cassette interfaces are specific to the Sinclair alone and connect only one specific device. The importance of the RS232 interface board is that it performs the proper conversion and generates the proper control functions according to a widely supported industry standard set by the Electronic Industries Association (EIA). For the price of a modem alone the Byte-Back system is not only a modem but also a generalized serial input/output (I/O) port that will allow the attachment of numerous peripherals to the Sinclair.

The port operates asynchronously. This means that the timing between characters is not controlled, while the timing within a character is. It supports all normal data transmission rates (as shown in Table 1). It also supports 5 to 8 bit per

Table 1. Clock frequency straps and mode instruction data bits used to select the BAUD rate.

Straps		Mode instruction	D0	BAUD rates 1	0	1
		Data bits	D1	0	1	1
				÷1	÷16	÷64
A	9600			9600	600	150
B	4800			4800	300	75
C	2400			2400	150	37.5
D	1200			1200	75	18.75

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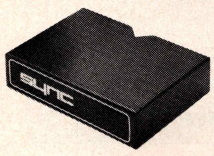

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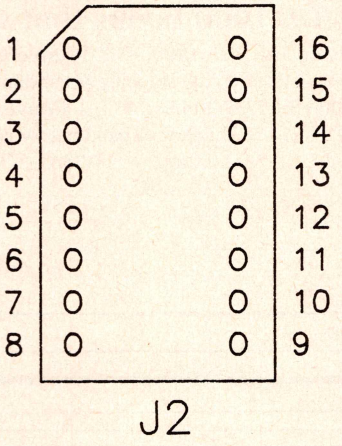
CIRCLE 9 ON READER SERVICE CARD

Exchanging data between machines opens up the prospects of electronic mail and access to large data banks.

character data codes, stop bit insertion and even/odd/off parity generation for error checking. Since it is a full duplex system, it can both talk and listen at the same time. Most of these options are software controlled; others by a combination of software and hardware jumpers. It also supports "handshaking" to an external device through its Clear to Send (CTS) line and its status register is available to Basic at any time.

The Byte-Back RS232 board is fully buffered and does not appear to interface with the Sinclair in any way. It is memory mapped into locations 38 and 39, and, since these are two empty places in the ROM, the RS232 board does not take up any RAM. Of course, it can be moved to some other location or a second RS232 device can be attached by changing some options on the board.

Figure 1. Byte-Back RS232 output plug.



*1. +9 Volts.
2. Transmitted data (TxD).
*3. Transmitted data (TxD).
4. N/C.
5. N/C.
6. N/C.
*7. -9 volts.
8. Ground.
16. Received data (RxD).
15. Clear to send (CTS).
14. N/C.
13. Data terminal rdy (DTR).
12. Request to send (RTS).
11. N/C.
10. RS232 output.
*9. RS232 input.

* RS232 level (-15 to +15 volts).
Other pins are at TTL levels (0 to +5 volts).

As an example of its flexibility, the same device that operates the modem at 300 BAUD with 7 bit ASCII codes, even parity into Compuserve can also communicate with "the Source" using 8 bit codes with no parity and make the switch with one Basic command.

At Byte-Back it has also been connected to a Radio Shack model VII dot matrix printer operating at 600 BAUD allowing the Sinclair to output to a line printer at any line width or character count. A Basic program illustrating this fact is included in the instructions and machine code programs to drive the model VII or other printers are available from the manufacturer for $29.95. In addition TTL, (0 to +5 volt) output is available on the board for those devices requiring those levels. Since the basic chip is an Intel 8251A Universal Synchronous/Asynchronous Receiver/Transmitter (USART), I would assume that other capabilities are also present.

A word of warning, however, because of the nature of the RS232 standard, (it is almost an "unstandard") you should not read too much into my description. The statement "standard RS232" in advertisements is about the only thing that is. Anytime an RS232 device you are not familiar with is connected to any RS232 interface the engineering data for both devices should be studied or the manufacturer consulted. The device will probably work but some engineering may be required. This is particularly true if the device requires handshaking.

An example of this is the fact that the Byte-Back RS232 board itself does not follow the standard. This is particularly obvious with the output plug. The RS232 standard describes a 25 pin "D" connector with every pin accounted for. Byte-Back uses a 16 pin wire wrap DIP socket with the pin assignments as shown in Figure 1. With its mixture of TTL and RS232 levels, this plug is definitely not standard RS232. The reason is that the modem utilizes only the TTL connections and the wire wrap pins on the plug allow it to fasten directly to and hang down behind the interface forming a single compact unit as shown in Figure 2.

All of the necessary RS232 levels are available somewhere on the board. Unfortunately, the arrangement makes it necessary to have good engineering knowledge of the interface. At the very least it will be necessary to fabricate a custom cable to connect the unit to other RS232 speaking peripherals. Fortunately, Byte-Back seems to be willing to aid the experimenter.

Data passing through the interface is still in digital form. This is fine for local communication between a computer and its peripherals but it is not suitable for transmitting data over the phone. This is because the telephone is an analog system. The modem transforms this data from the computer into tones, then modulates those tones onto a carrier frequency and transmits the resulting analog signal over the telephone lines. When it is receiving, it demodulates the carrier and reconstructs the original digital data stream. (The word *modem* is a contraction of *mod*ulate and *dem*odulate.)

At 300 BAUD there are basically two kinds of modems, acoustic and direct connect. Acoustic modems are distinguished by a rubber cradle which is used to hold the telephone handset. Communication with the phone line is through the microphone and receiver of the handset. The direct connect modem is attached directly to the phone line. It is either hardwired into the baseboard junction box or attached through a plug.

The Byte-Back modem is the direct connect type but with a difference: to save cost, line holding circuitry is not included.

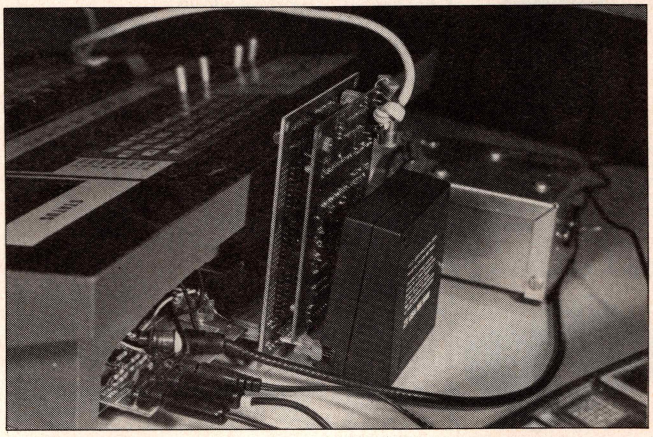


Figure 2. Author's ZX80, RS232, and modem.
(Note: Sinclair 16K RAM pack attached to expansion plug.)

After communication with the host system is established, it is not posssible to press a button and hang up as with other modems. The phone must be left off the hook and muffled in some manner to keep room noise out of the data. This may be objectionable to some, but remember that as modems go, the Byte-Back unit is very inexpensive. However, it is also true that it lacks the portability of an acoustic modem without furnishing the noise immunity of the direct connect type. It appears that the problem is easily corrected with the addition of a switch and a holding coil, but I can unplug my handset and so it does not bother me at all.

Figure3. RS232 interface board layout.

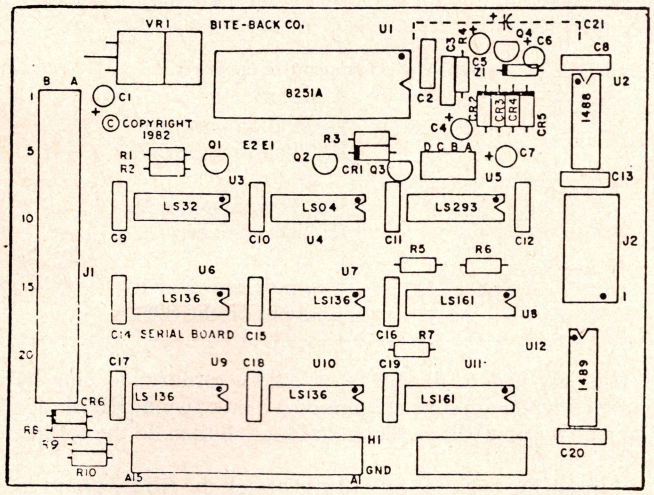
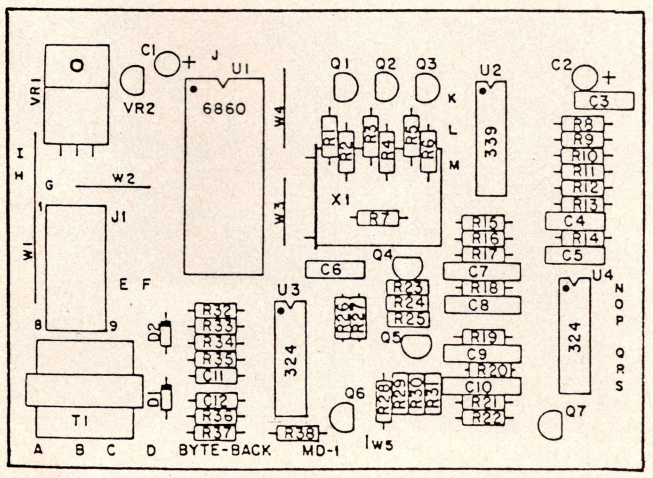


Figure 4. Modem board layout.



The Kit in General

In kit form the system consists of two printed circuit boards, two bags of parts, a software cassette, and two sets of instructions. The boards I received were of excellent quality, solder masked with the component layout printed on the board as shown in Figures 3 and 4. These improvements over earlier boards greatly facilitated assembly. Although my kit was one of the first available, no modifications were required, and, once functional, it has operated flawlessly.

Basically, the builder is told to assemble the components to the board in the locations indicated by the layout drawing printed on the board. There are no step-by-step instructions with the little boxes to check off as each step is completed. The assembly can be done in any sequence "with the following exceptions" (one or two pages of execptions follow).

This works reasonably well in practice if a policy of mounting the smallest parts first is followed unless otherwise

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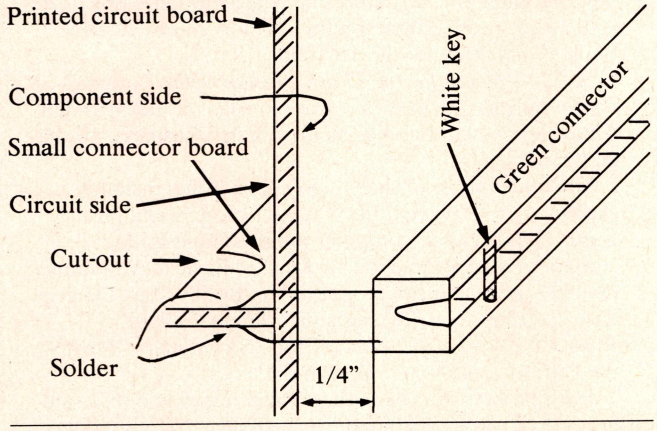
Anyone with some electronic assembly experience should have little trouble although some dexterity is required as the boards are packed.

directed by an "exception." Since I do not have the resistor color code down cold and I was not sure I could identify the rest of the parts, I found myself paging back and forth between the parts list (where some parts identification information is given) and the "exceptions" sheet (where additional parts identification is made). I also found that it helped to check the components off on the parts list as they were installed.

The assembly presented no surprises, and I was able to put the kit together in about 6 hours. Anyone with some electronic assembly experience should have little trouble, although some dexterity is required as the boards are packed and the traces are close. I found a 25 watt soldering iron with a .1 inch grounded tip to be essential. Those with no experience in kit building whatsoever would probably find the assembled version worth the extra cost.

Figure 5. Expansion connection.



Finally, the warranty and company attitude should be mentioned as they are of distinct advantage to the kit builder and computer hobbyist. The warranty is for the usual 90 days, but it is unique in that it applies to the kit as far parts and factory defects are concerned. It does not apply if the kit is assembled wrong. It remains valid even if you attempt to repair any malfunction yourself! As an additional aid to the kit builder, the chief engineer answers the phone on evenings and weekends when most of us are working on our projects. As my kit came with a defective chip (which was immediately replaced), I came to value this service. I found him to be patient and helpful. Most of the troubleshooting and checkout hints in this article are his.

The RS232 Board

Assembly of the RS232 board presented few difficulties. The major point of interest was the expansion plug (J1 on Figure 1).

Having assembled several kits using the same type of expansion interface as Byte-Back, I have found it almost impossible to get a reliable solder joint on the male side of the connector unless the wire wrap pins are bent as shown in Figure 5. This is accomplished by grasping the pin with needle nose pliers, holding the pliers at right angles to the board and moving the tip parallel to it. The result should be a pin bent in the shape of a crank as shown. Simply bending the pins toward the expansion board to form a V with the board in the middle will not give enough surface area to insure a secure solder connection as the board is bent and flexed during installation.

When the RS232 board is completed, it can be checked out and proper operation verified before connecting the modem. This requires a minor hardware modification. The following procedure was developed after conversation with the chief engineer at Byte-Back and involves getting the board to talk to itself. This is easy because it operates in full duplex mode (it can send and receive at the same time) all that is necessary is to interconnect the pins on J2 as shown on Table 2.

Table 2. Pin assignments for checkout.

Pin	Pin	Remarks
10	16	Serial data input to RS232 level translator.
3	9	RS232 transmitter to RS232 receiver.
8	15	Grounds the clear to send pin on the 8251A.

The easy way to do this is to build a turnaround plug by connecting the appropriate pins on a blank 16 pin DIP header (Jameco # 16pinHP) as shown in Figure 6 then do the following:

1) Insert the test plug into J2 and attach the RS232 board to the Sinclair edge connector.

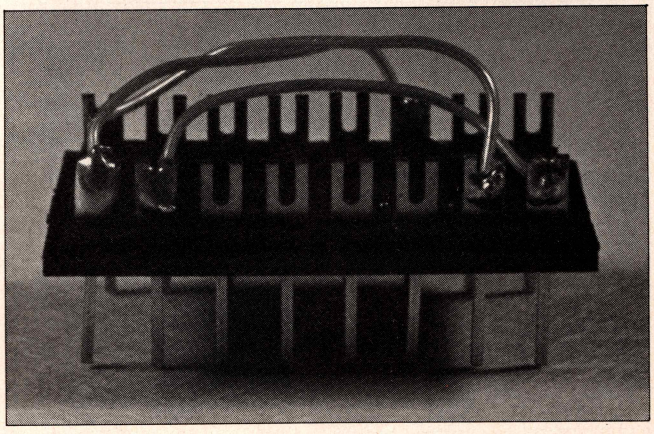


Figure 6. Turnabout plug.

2) Turn on the Sinclair and look for smoke. Do not worry, the board is fully buffered and has its own power supply so it is almost impossible to hurt the Sinclair if a mistake is made on the RS232 board.

3) If nothing is obviously wrong, key in the program given in Listing 1 and record it.

Listing 1. Turnabout test.

```
10 POKE 39,122          60 IF A =I THEN GOTO 100
20 POKE 39,23           70 PRINT "FAIL"
30 FOR I= 0 TO 127      80 STOP
40 POKE 38,I            100 NEXT I
45 PAUSE 2              110 PRINT I
50 LET A = PEEK 38      120 GOTO 30
```

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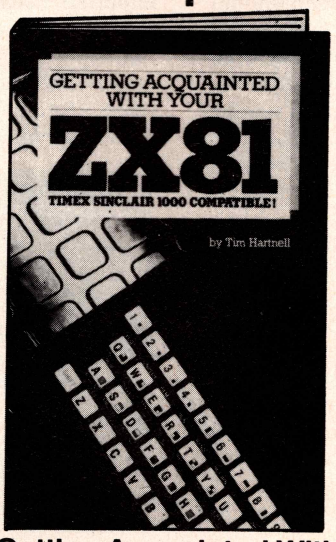

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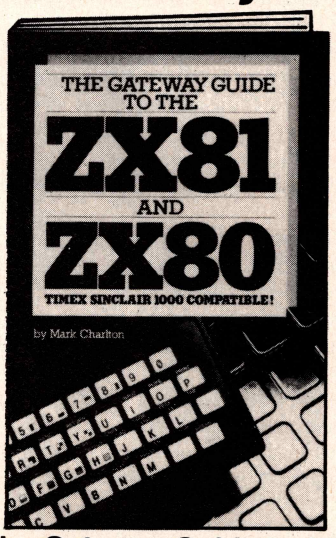

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4) Run the program in SLOW mode unless the PAUSE in line 45 is increased to 10 (this is important if a ZX80 without a video upgrade is used). In SLOW mode the screen should flash 128 times then the number 128 should appear, after which the screen should start to flash again. If the word FAIL appears at any time, the board is defective and either trouble-shooting or factory service is in order. The program can be stopped at any time by pressing the BREAK key, but, if it is restarted or executed a second time, it should always be with a RUN 20 or GOTO 20 unless the power has been interrupted.

The first few lines of the program establish the data communication mode and turn on the board's transmitter and receiver. The signal timing and error checking system to be used are also set at this time. The rest of the program transmits codes from 0 to 127 to the receiver, checks the receiver output to see if it matches what was transmitted, and sends the next code if it does. Only 128 codes are sent because the mode instruction in line 10 established a seven bit data code with one parity bit (the eighth) for error checking and only 128 codes can be sent with 7 bits.

Modem Assembly and Checkout

Assembly of the modem presented few problems largely because the instructions were more or less step by step, unlike the instructions for the RS232 board. It is worth noting, however, that the company tacks an extra charge on to any repair if the components have been mounted "face down" so that the values are not visible. This is the first time I have seen this, but it does motivate good assembly practice.

The modem is attached to the interface by plugging the projecting wire wrap pins on interface plug J2 into J1 on the modem as shown in Figure 7. Care should be exercised as the pins are long, may not be properly aligned or straight and are easily bent. Orientation of the heat sink on the interface is important because it and transistor Q7 on the modem establish the space between the two boards. I know from experience that modem components, particularly the transformer and crystal, will short out the RS232 board, producing expensive odors. Byte-Back has recently included a case for the unit. I wish I had one.

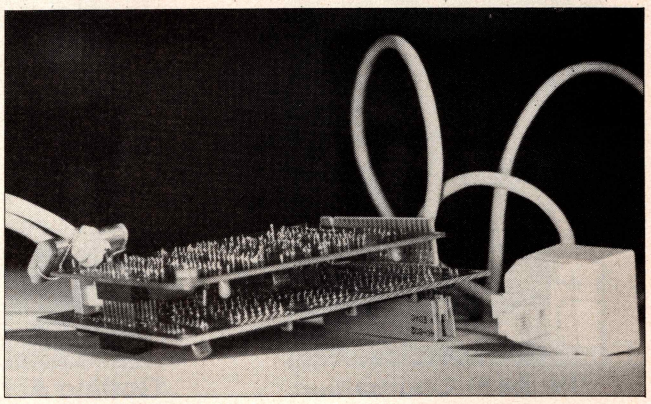


Figure 7. RS232 interface with piggyback modem. (Note: Modular plug: Radio Shack 279-375.)

Connecting the modem to the telephone service may be a problem although adequate instructions are given and the newer units come with a modular plug. It is a good idea to disconnect the modem from the telephone when not in use, particularly in those parts of the country where electrical storms are common. Since a telephone must be used for dialing and answering, a duplex jack (Radio Shack # 279-357) should be used, and the phone connected in parallel with the modem.

It is not necessary to subscribe to a computer service to check out the modem; all that is needed is a telephone number. Of course, the service will evict anyone who cannot produce a password at the proper time but most computer services are patient and enough communication will take place during the login attempt to verify proper terminal function.

Since Byte-Back software is configured at the factory for communication with Compuserve, I decided to visit them for checkout. To get the local Compuserve number I called (800) 848-8990 and asked for a local number in my area. Since Copuserve does not have a local number everywhere, I was also prepared to use the University of Alabama at Huntsville (UAH) bulletin board at (205) 895-6749 (ring once, call back within 40 seconds). Many universities maintain such services. So do many computer clubs. It should be understood, however, that these are amateur systems and they crash a lot, so do not get discouraged.

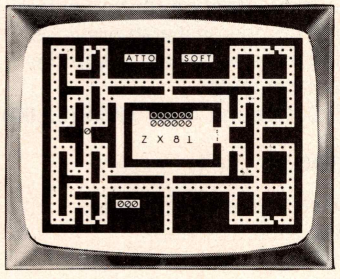
With the modem plugged into the telephone line and a valid telphone number the system is ready for checkout. This is done by the following steps:

1) LOAD the modem software into the Sinclair.

2) Make sure that the computer is in the SLOW mode (the software will not work on a ZX80 without a video upgrade).

3) RUN the program and answer the prompts by entering "O" and "N" for originate and echo. In a few moments the words "BYTEBACK INC. GLASS TTY" will appear on the screen, indicating that the system is standing by waiting for an answer tone from another modem.

4) Dial the host computer. When it answers, its modem will generate an answer tone (2000Hz). This will be followed immediately by the originate tone (1000Hz) from the Byte-Back unit. If this occurs, the unit can be considered at least partially functional.



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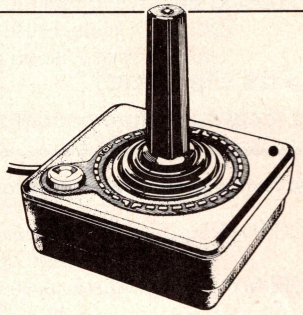

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CIRCLE 4 ON READER SERVICE CARD

My dog barked. Then the host computer filled my screen with garbage and hung up!

5) Do not hang up the phone at this time! Either wrap the receiver in a towel, smother it in a pillow or, if it has a modular handset, remove the handset plug from the telephone base. This is important! Once when I was on line to Compuserve, my dog barked, causing the host computer to fill my screen with garbage and hang up.

6) After the two modems exchange tones, the host will immediately start sending a message that will appear on the screen. If the message is in clear English text, the system works, and communications have been established! Go out and celebrate. If assorted jumbled characters, try PEEKing the mode instruction to make sure that the configuration matches that required by the host.

What Will It Do?

The Byte-Back modem system as delivered will convert the Sinclair ZX80/81 into what is popularly known as a "dumb terminal." Also it furnishes the capability to connect that terminal to a host computer via the telephone. As with most "dumb terminals" the user can dial up a properly equipped remote computer, command it to execute programs local to it, and receive the results on the TV attached to the Sinclair.

With the software supplied, the only way to retain the output is to halt the terminal program, reenter Basic and COPY the screen to the printer (if one is available). If this is done, however, the remote site may hang up the phone. Also it is not possible to "download" or copy software from any remote site, even another Sinclair. Having examined the terminal software (available from Byte-Back) for $10 and probably worth it, I have good news: the limitations mentioned are not in the hardware. I should point out that the software works well; it is just limited, but then so is the cost.

Since I have installed my modem, I have used it to communicate with several systems. I have been able to command the execution of Fortran and Cobal jobs on the large mainframe computer where I work. An example of this is shown in Figure 8a; sample output is shown in Figure 8b. This program was executed about 15 miles from my home, both the listing and the output were COPYed on my Sinclair. Yes, I am running Fortran jobs from a Sinclair computer.

On a more mundane level I have exchanged notes with Apple, Atari, and other computer owners on the bulletin board at the University and determined on Compuserve that it was raining in Brazil. A complete listing of what is available out there in "computerland" is beyond the scope of this article, but one thing I have enjoyed is the encyclopedia research service that several large systems offer. Just enter the subject, and within a few seconds the complete encyclopedia article appears on the screen!

After some experience, I feel that the larger systems are easier to communicate with. The Sinclair is definitely limited in some respects, and it helps to deal with a system that has enough capability to adjust. Things like page size, interrupt and abort codes often need to be negotiated, and most of the major services can. For example, I have found it helpful to direct the host to send upper case characters only. The Byte-Back software can deal with any incoming ASCII code, but it converts lower case into inverse video. This results in a display that looks a bit like a ransom note, and it is hard to read (Figure 9).

The modem software will LOAD in 2K. The price of the Byte-Back kit is about $120. The TS1000 now costs less than $70 (even as low as $50). So for less than $200 you can command the resources of a computer that costs in excess of $16 million! That ought to satisfy anyone's power hunger!

If I have inspired you to share my disease and get into data communications with your Sinclair, give me a call on the UAH bulletin board and leave me a message. I would like to hear from you. ■

Figure 8. Remote job execution.

Figure 8a. Fortran listing.

```
00100 PROGRAM HERO(INPUT,OUTPUT)

00110 1READ*,A,B,C
00120 IF(A.EQ.0.0)STOP
00130 S=(A+B+C)/2.0
00140 RDCL=S*(S-A)*(S-B)*(S-C)
00150 IF(RDCL.LT.0.0)GOTO 2
00160 AREA=SQRT(RDCL)
00170 PRINT 101,A,B,C,AREA
00180 GOTO 1
00190  2 PRINT 102,A,B,C
00200 GOTO 1
00210  101 FORMAT(10H SIDES ARE,
 3F9.4/8H AREA IS, 1PE11.4)
00220 102 FORMAT(10H SIDES ARE,
3
230+ F9.4/17H INVALID TRIANGLE)
00240 END

 READY.
■
157
```

Figure 8b. Sample run.

```
? 3,6,8
 SIDES ARE    3.0000    6.0000    8
.0000
 AREA IS 7.6444E+00
? 5,10,15
 SIDES ARE    5.0000   10.0000   15
.0000
 AREA IS 0.
? 5,5,5
 SIDES ARE    5.0000    5.0000    5
.0000
 AREA IS 1.0825E+01
? 0
? 0.0,0,0

SRU       1.114 UNTS.

 RUN COMPLETE.
■
149
```

Figure 9. Author's ZX80 on line to Compuserve. (Note: The telephone handset is unplugged.)

3D Monster Maze and Mothership

David Grosjean

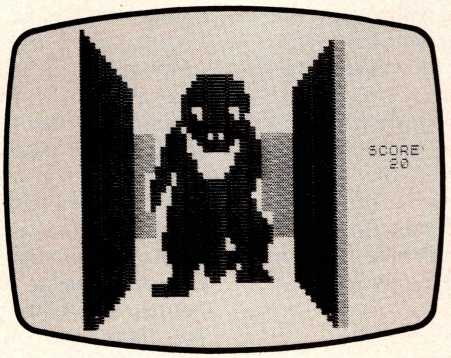
In *3D Monster Maze* you are in a maze running from T. (Tyrannosaurus) Rex. The object is to get out alive!

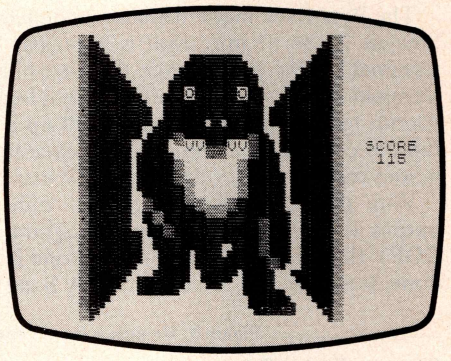
The game begins with a circus barker telling you the background of the maze. He then gives you the choices of seeing the instructions, quitting, or starting. The computer takes less than 30 seconds to set up the maze, and then the action begins.

You are walking (or running) down a corridor which has dark black walls, while the corridors branching off your path have grey walls. Messages at the bottom of the screen give you reports such as "He is hunting for you," "Rex has seen you," and "RUN he is beside you." Each step increases your score by 5 points. When you reach the exit, you are awarded 200 points and put in a new maze. The instructions do not tell you what the exit looks like, but, when you see it, you know that you have escaped.

The game is very easy to get used to, but it is difficult to win consistently. The controls are simple: the arrow keys are used to indicate left, right, and forward (up).

The program uses Basic and mostly machine code (to produce and move the pictures quickly). Although the pixels on the TS1000 are rather coarse, the 3-D simulation is marvelously effective. The illusion of a corridor with extension is created by converging lines, and Rex gets larger as he gets closer. The simplicity and speed of this program make it fun for all ages.





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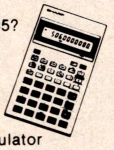

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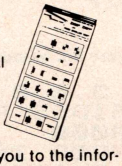

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SYNC

Software Profile

Name: 3D Monster Maze
Type: Arcade game
System: 8K ROM; 16K RAM
Format: Cassette
Summary: Remarkably effective 3D simulation with a fun game. Rex *is* after you!
Price: $14.95 plus $2 s&h per order.
Manufacturer:
Melbourne House Software
Dept. CS, 347 Reedwood Dr.
Nashville, TN 37217

Mothership is a space combat game with a 3-D simulation. The top half of the screen shows the stars of outer space in a stationary background while the bottom half shows a trench (somewhat like the one in Star Wars when the Death Star is destroyed). You are in your fighter flying down this trench. Your controls (left, right, up, down, and fire) are easy to get used to. The illusion of depth comes from the use of converging lines to show the trench, and the illusion of flight from the constantly changing display.

SYNC

Software Profile

Name: Mothership
Type: Arcade Game
System: 8K ROM; 16K RAM
Format: Cassette
Summary: A challenging game and excellent use of graphics make this a superb game and a lot of fun.
Price: $16.95.
Manufacturer:
Softsync, Inc.
14 E. 34th St.
New York, NY 10016

At first you are fighting drones which emanate from the huge mothership seen cruising back and forth across the top of your screen. They fly towards you while shooting, or they simply fly at you on suicide missions. The drones are worth from 100 to 500 points depending on where you are in the corridor. The higher up in the corridor you are, the more the drones are worth, and the faster everything moves. After shooting ten drones without losing one of your ships, the drone attack stops, and the mothership begins shooting at you. You must hit it three times before it is destroyed. You are awarded from 1000 to 5000 points depending on where you are in the corridor.

There are three levels of difficulty. In the first, the drones do not shoot at you. In the second, the drones do shoot at you. The third level is just like the second except that it is much more difficult. You do not crash if you hit the sides of the corridor in the first two levels, but you do in the third. Up to two people can play individually.

This game is simple, yet it can get very difficult. The speed, smoothness, and excellent use of graphics make this a superb game and a lot of fun.

It is not surprising then that *Mothership* is one of the five award winning programs in the Timex Sinclair category at this year's Consumer Electronics Showcase and that it is the only U.S. software package bought by Sinclair for British distribution. Three other Softsync entries are also among the five award winners: *Mazogs* (reviewed in *SYNC* 2:6), *Quest for the Holy Grail,* and *TS Destroyer.*

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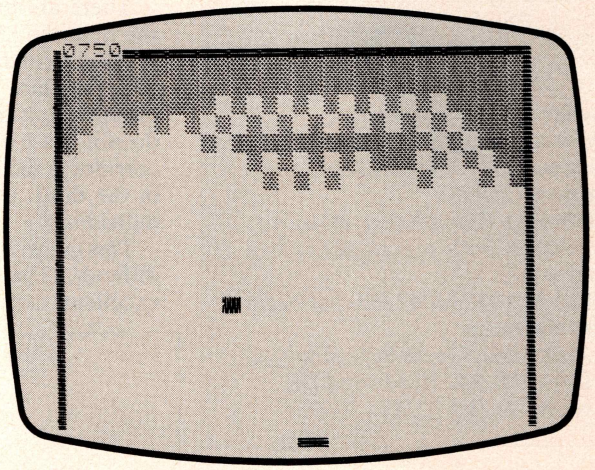
CIRCLE 61 ON READER SERVICE CARD

Brick Buster

Paul Thomson



"Brick Buster" is a game in which the player earns points by knocking out as many of the bricks in the playing area as possible. On-screen scoring and a high score memory are provided for competitive playing. The active part of the game is written in machine code for fast action. The rest of the game is in Basic for ease of programming.

Using the machine code loader program in Figure 1 (or your own program, if you prefer), enter the machine code from the second column in Figure 2 into the first REM statement. Check the address on the screen after each entry to make sure that it corresponds to Figure 2. After the machine code is entered, be very careful not to alter the REM statement in any way. Save it now in case of a crash later.

Figure 1. Machine code loader.

```
   1 REM 12345678901234567890123
4567890123456789012345678901234
5678901234567890123456789012345
6789012345678901234567890123456
7890123456789012345678901234567
8901234567890123456789012345678
9012345678901234567890123456789
0123456789012345678901234567890
1234567890123456789012345678901
2345678901234567890123456789012
3456789012345678901234567890123
4567890123456789012345678901234
5678901234567890123456789012345
6789012345678901234567890123456
7890123456789012345678901234567
8901234567890123456789012345678
9012345678901234567890
  10 LET L=16514
  20 LET L$="4082"
  30 SCROLL
  40 PRINT L$;" ";
  50 INPUT A$
  60 IF A$="S" THEN STOP
  70 PRINT A$
  80 IF A$="" THEN GOTO 30
  90 POKE L,16*CODE A$+CODE A$(2
)-476
 100 LET L=L+1
 110 LET A$=A$(3 TO )
 120 LET B=4
 130 LET A=CODE L$(B)+1
 140 IF A>43 THEN GOTO 200
 150 LET L$=L$( TO B-1)+CHR$ A
 160 FOR F=B-1 TO 2
 170 LET L$=L$+"0"
 180 NEXT F
 190 GOTO 80
 200 LET B=B-1
 210 GOTO 130
```

Figure 2. Machine code listing.

```
4082  111016          LD DE,1610      ; Initialize paddle position.
4085  010516          LD BC,1605      ; Initialize ball position.
4088  78        START: LD A,B          ; Has ball hit back wall?
4089  FE02           CP 02           ;
408B  2007           JR NZ,MISS      ; No. Go check for a miss.
408D  3E04           LD A,04         ; Yes. Change vertical direction.
408F  32AC40         LD (BINST),A    ;
4092  1803           JR LWALL        ; Go check left wall.
4094  FE18     MISS: CP 18           ; Did ball get past paddle?
4096  C8             RET Z           ; Yes. Return to Basic.
4097  79       LWALL: LD A,C          ; No. Has ball reached left wall?
4098  FE02           CP 02           ;
409A  2007           JR NZ,RWALL     ; No. Go check right wall.
409C  3E0C           LD A,0C         ; Yes. Change horizontal direction.
409E  32AD40         LD (CINST),A    ;
40A1  1809           JR BINST        ; Go change ball direction.
40A3  FE1F     RWALL: CP 1F          ; Has ball reached right wall?
40A5  2005           JR NZ,BINST     ;
40A7  3E0D           LD A,0D         ; Yes. Change horizontal direction.
40A9  32AD40         LD (CINST),A    ;
40AC  05       BINST: DEC B          ; No. Change position of ball.
40AD  0D       CINST: DEC C          ; (B: vertical; C: horizontal).
40AE  CD5541         CALL ADDR       ; Find new address of ball.
40B1  7E             LD A,(HL)       ; Is there a brick in new ball position?
40B2  FE08           CP 08           ;
40B4  2016           JR NZ,SUBS      ; No. Go move ball.
40B6  CD6A41         CALL SCORE      ; Yes. Go increment score.
40B9  3AAC40         LD A,(BINST)    ; Make ball bounce off brick in
40BC  FE05           CP 05           ; opposite vertical direction.
40BE  2007           JR NZ,BOUNCE    ;
40C0  3E04           LD A,04         ;
40C2  32AC40         LD (BINST),A    ;
40C5  1805           JR SUBS         ;
40C7  3E05    BOUNCE: LD A,05        ;
40C9  32AC40         LD (BINST),A    ;
40CC  3680     SUBS: LD (HL),80      ; Print ball in new position.
40CE  CDE040         CALL PADDLE     ; Move paddle.
40D1  CD8241         CALL DELAY      ; Delay.
40D4  CDE040         CALL PADDLE     ; Move paddle.
40D7  CD8241         CALL DELAY      ; Delay.
40DA  3600           LD (HL),00      ; Print blank in old ball position.
40DC  18AA           JR START        ; Go back to start.
40DE  00             NOP             ;
40DF  00             NOP             ;
40E0  E5       PADDLE: PUSH HL       ; Save ball position.
40E1  C5               PUSH BC       ;
40E2  42               LD B,D        ; Get paddle position.
40E3  4B               LD C,E        ;
40E4  DB04             IN A,04       ; Find what key is pressed.
40E6  FE3B             CP 3B         ; Move right?
40E8  2008             JR NZ,MVLF    ; No. Go check for move left.
40EA  79               LD A,C        ; Yes. Is paddle at right end?
40EB  FE1D             CP 1D         ;
40ED  280D             JR Z,PRPADL   ; Yes. Go print paddle.
40EF  0C               INC C         ; No. Move paddle position to right.
40F0  180A             JR PRPADL     ; Go print new paddle.
40F2  FE2F     MVLF: CP 2F           ; Move left?
40F4  2006             JR NZ,PRPADL  ; No. Go print paddle.
40F6  79               LD A,C        ; Yes. Is paddle at left end?
```

Paul Thomson, 361 W. Windsor, Lombard, IL 60148.

```
40F7  FE01            CP 01          ;
40F9  2801            JR Z,PRPADL    ; Yes. Go print new paddle.
40FB  0D              DEC C          ; No. Move paddle position to left.
40FC  CD5541  PRPADL: CALL ADDR      ; Find paddle address.
40FF  3600            LD (HL),00     ; Print paddle.
4101  23              INC HL         ;
4102  3603            LD (HL),03     ;
4104  23              INC HL         ;
4105  3603            LD (HL),03     ;
4107  23              INC HL         ;
4108  3600            LD (HL),00     ;
410A  05              DEC B          ; Check if ball hit paddle.
410B  CD5541          CALL ADDR      ;
410E  3AAD40          LD A,(CINST)   ;
4111  FE0C            CP 0C          ;
4113  200F            JR NZ,MIDPAD   ;
4115  7E              LD A,(HL)      ; Check left end of paddle.
4116  FE80            CP 80          ;
4118  200A            JR NZ,MIDPAD   ;
411A  3E0D            LD A,0D        ;
411C  32AD40          LD (CINST),A   ;
411F  3E05            LD A,05        ;
4121  32AC40          LD (BINST),A   ;
4124  0602    MIDPAD: LD B,02        ;
4126  23       TWICE: INC HL         ; Check center sections of paddle
4127  7E              LD A,(HL)      ; for hit.
4128  FE80            CP 80          ;
412A  200C            JR NZ,CONT     ;
412C  3E05            LD A,05        ;
412E  32AC40          LD (BINST),A   ;
4131  D9              EXX            ; If ball hits center of paddle,
4132  C1              POP BC         ; project ball one extra position
4133  0614            LD B,14        ; vertically to make sure all bricks
4135  C5              PUSH BC        ; can be hit.
4136  D9              EXX            ;
4137  00              NOP            ;
4138  10EC     CONT:  DJNZ TWICE     ;
413A  23              INC HL         ;
413B  3AAD40          LD A,(CINST)   ;
413E  FE0D            CP 0D          ;
4140  200F            JR NZ,ENDPAD   ;
4142  7E              LD A,(HL)      ; Check right end of paddle.
4143  FE80            CP 80          ;
4145  200A            JR NZ,ENDPAD   ;
4147  3E0C            LD A,0C        ;
4149  32AD40          LD (CINST),A   ;
414C  3E05            LD A,05        ;
414E  32AC40          LD (BINST),A   ;
4151  59      ENDPAD: LD E,C         ;
4152  C1              POP BC         ; Get ball position.
4153  E1              POP HL         ;
4154  C9              RET            ;
4155  D5       ADDR:  PUSH DE        ; Save paddle position.
4156  C5              PUSH BC        ; Save ball position.
4157  2A0C40          LD HL,D-FILE   ; Get display address.
415A  C5              PUSH BC        ;
415B  0600            LD B,00        ;
415D  09              ADD HL,BC      ; Find horizontal position.
415E  C1              POP BC         ;
415F  112100          LD DE,0021     ;
4162  1003      TEST:  DJNZ AGAIN     ;
4164  C1              POP BC         ; Get ball position.
4165  D1              POP DE         ; Get paddle position.
4166  C9              RET            ;
4167  19       AGAIN: ADD HL,DE      ; Find vertical position.
4168  18F8            JR TEST        ;
416A  E5       SCORE: PUSH HL         ; Save ball address.
416B  2A0C40          LD HL,D-FILE   ; Get display address.
416E  23              INC HL         ; Find tens position in score.
416F  23              INC HL         ;
4170  23              INC HL         ;
4171  23              INC HL         ;
4172  7E       CHECK: LD A,(HL)      ; Add 10 to score.
4173  3C              INC A          ;
4174  FE26            CP 26          ;
4176  2803            JR Z,CARRY     ;
4178  77              LD (HL),A      ;
4179  1805            JR ENDSCR      ;
417B  361C     CARRY: LD (HL),1C     ;
417D  2B              DEC HL         ;
417E  18F2            JR CHECK       ;
4180  E1     ENDSCR: POP HL         ; Get ball address.
4181  C9              RET            ;
4182  C5      DELAY: PUSH BC        ; Save ball position.
4183  010002          LD BC,0200     ; Load delay.
4186  0B     CNTDWN: DEC BC         ;
4187  78              LD A,B         ;
4188  B1              OR C           ;
4189  20FB            JR NZ,CNTDWN   ; Continue with delay.
418B  C1              POP BC         ; Get ball position.
418C  C9              RET            ;
```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Next, enter the Basic part of the game. Enter the lines in Figure 3 over the first program. Be sure to leave the REM statement alone. Make sure you enter the Basic just as in Figure 3. The line notes will help.

After the Basic part of the game is entered, you are all set to play. Again to be safe, SAVE the whole program now by typing RUN 500. When you LOAD the program to play again, it will start running by itself. After it is LOADed, the computer will ask you to enter the speed of play. Five or greater is suggested for the beginner. After you enter the speed, the playing field is drawn. You have 5 balls per game. You serve the ball by pressing S. The paddle is controlled by the 5 and 8 keys. Each brick is worth 10 points. At the end of the game, if you have the highest score so far, you get to enter your name which will stay in memory until your score is beaten or the program is stopped.

Line notes:

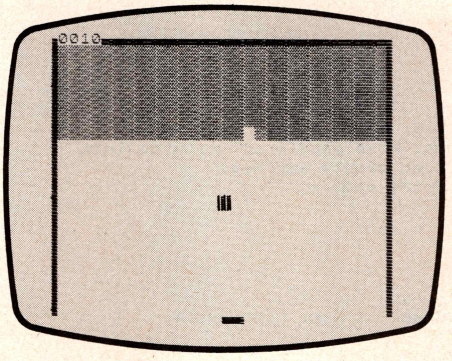
70: 3, zero (4), 6 (26), 4.

90: 8, 5.

120: A (32).

190: Space (32).

280: In inverse: PRESS "P" TO PLAY AGAIN.



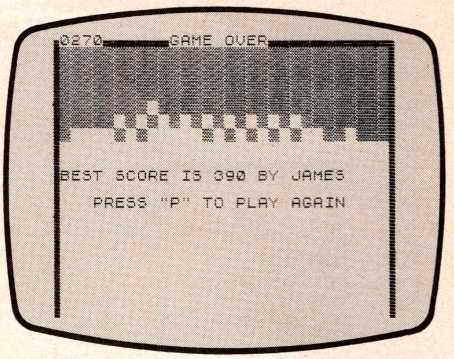


Figure 3. The Basic program.

```
  5 LET DISP=PEEK (16396)+PEEK
(16397)*256
 10 LET BEST=0
 15 CLS
 20 PRINT "ENTER SPEED 1 TO 9
(1=FASTEST)"
 25 PRINT AT 3,6;"<=5....8=>
S=SERVE"
 30 INPUT I
 40 IF I<1 OR I>9 THEN GOTO 30
 50 POKE 16773,I
 60 CLS
 70 PRINT "▪0000▬▬▬
```

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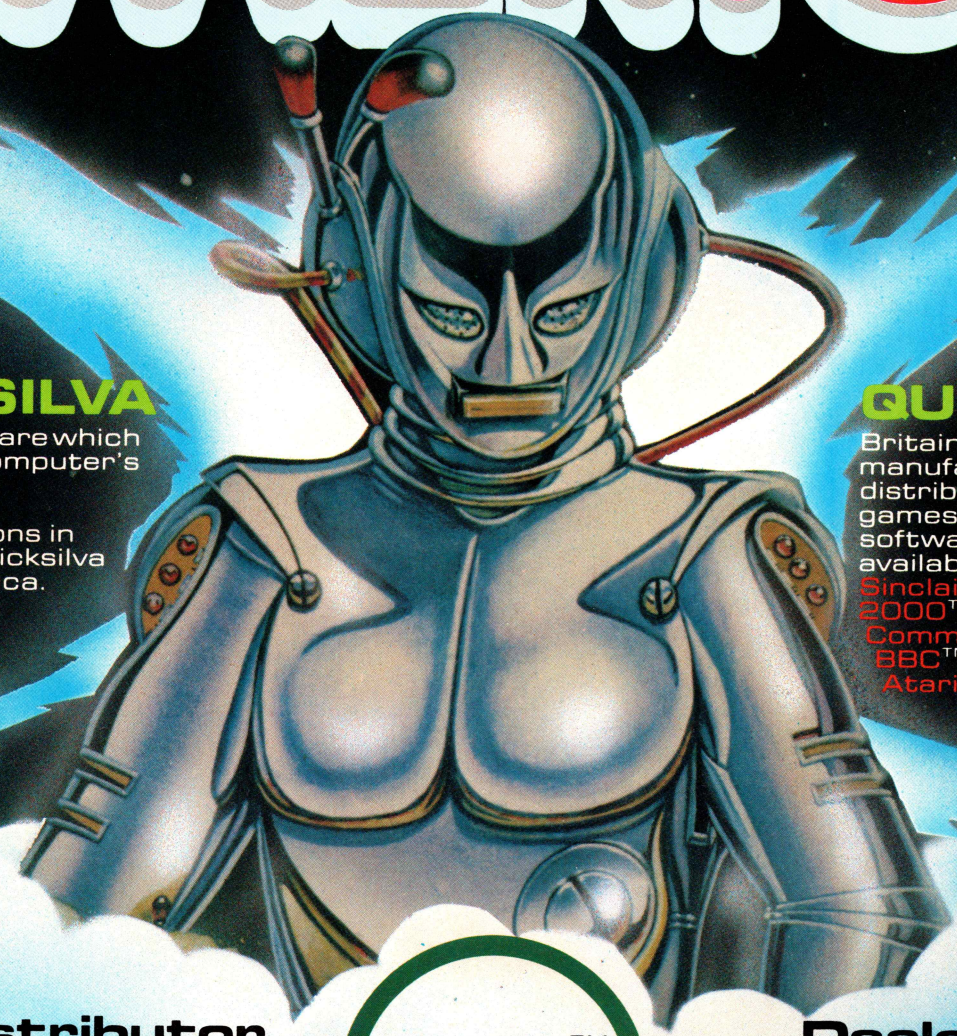

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